

=> file reg

FILE 'REGISTRY' ENTERED AT 18:59:20 ON 10 MAY 2005
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=> display history full 11-

FILE 'REGISTRY' ENTERED AT 17:03:09 ON 10 MAY 2005

E SULFUR DIOXIDE/CN
L1 1 SEA "SULFUR DIOXIDE"/CN
E OXYGEN/CN
L2 1 SEA OXYGEN/CN

FILE 'HCA' ENTERED AT 17:07:11 ON 10 MAY 2005

L3 71514 SEA L1
L4 3283 SEA L1/P
L5 362620 SEA L2
L6 26318 SEA (LIQ# OR LIQUIF? OR LIQUEF? OR LIQUID? OR FLUID? OR
FLUEF? OR MOLTEN? OR MELT? OR FUSE# OR FUSING# OR
FUSION?) (2A) (L1 OR SULFUR# OR SULFER# OR SULPHUR# OR
SULPHER# OR S OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8
OR S9 OR S10)

FILE 'REGISTRY' ENTERED AT 17:07:24 ON 10 MAY 2005

E SULFUR/CN
L7 1 SEA SULFUR/CN

FILE 'HCA' ENTERED AT 17:09:58 ON 10 MAY 2005

L8 131348 SEA L7
L9 64 SEA (RETURN? OR RE(W) (ENTER? OR ENTRY? OR ENTRIES) (2A) (L
1 OR SO2 OR (SULFUR# OR SULFER# OR SULPHUR# OR SULPHER#) (W)
DIOXIDE#)

FILE 'LCA' ENTERED AT 17:10:05 ON 10 MAY 2005

L10 2452 SEA (RECOVER? OR RECLAMAT? OR RECLAIM? OR RETRIEV? OR
SALVAG? OR REGENERAT? OR RECONDITION? OR REFORM? OR
RECONSTITUT? OR REUSE# OR REUSING# OR RECYCL? OR
REPROCESS?)/BI,AB
L11 4 SEA (RE(W) (COVER? OR CLAMAT? OR CLAIM? OR GENERAT? OR
CONDITION? OR FORM? OR CONSTITUT? OR USE# OR USING# OR
CYCL? OR PROCESS?))/BI,AB

FILE 'HCA' ENTERED AT 17:12:10 ON 10 MAY 2005

L12 3442 SEA (L10 OR L11) (2A) (L1 OR SO2 OR (SULFUR# OR SULFER# OR

SULPHUR# OR SULPHER#) (W)DIOXIDE#)

L13 36 SEA L9 AND L3
 L14 6 SEA L9 AND L4
 L15 3 SEA L9 AND L5
 L16 2 SEA L9 AND L6
 L17 17 SEA L9 AND L12
 L18 2841 SEA L12 AND L3
 L19 679 SEA L12 AND L4
 L20 91 SEA L12 AND L5
 L21 84 SEA L18 AND L20
 L22 19 SEA L21 AND L19
 L23 6 SEA L21 AND L6
 L24 24 SEA L21 AND L8
 L25 1 SEA L21 AND L9
 L26 13658 SEA (L2 OR OXYGENA? OR O2 OR OXYGEN# OR O) (2A) (PURE# OR
 PURIF? OR PURIT?)
 L27 121 SEA L3 AND L26
 L28 18 SEA L27 AND L4
 L29 26 SEA L27 AND L8
 L30 63 SEA L27 AND L5
 L31 8 SEA L27 AND L6
 L32 0 SEA L27 AND L9
 L33 12 SEA L27 AND L12

FILE 'LCA' ENTERED AT 18:30:52 ON 10 MAY 2005

L34 1545 SEA L2 OR OXYGENA? OR O2 OR (OXYGEN# OR O) (2A) (ATM# OR
 ATMOS? OR GAS## OR GASEOUS? OR GASIF? OR FLOW? OR
 STREAM? OR SOURC? OR SUPPLY OR SUPPLIED OR FURNISH? OR
 APPLY? OR APPLIED OR APPLICATION? OR INLET? OR PORT OR
 PORTS OR PORTAL? OR JET OR JETS OR SYRING? OR NEEDL?)
 L35 1497 SEA L2 OR OXYGENA? OR O2 OR (OXYGEN# OR O) (2A) (TREAT? OR
 PRETREAT? OR CONDITION? OR PRECONDITION? OR PROCESS? OR
 INTRODUC?)

FILE 'HCA' ENTERED AT 18:38:51 ON 10 MAY 2005

L36 620148 SEA L34 OR L35 OR OXYGENA?
 L37 11680 SEA (L3 OR SO2 OR (SULFUR# OR SULFER# OR SULPHUR# OR
 SULPHER#) (W)DIOXIDE#) AND L36

FILE 'LCA' ENTERED AT 18:40:31 ON 10 MAY 2005

L38 32137 SEA (PRODUC? OR PROD# OR GENERAT? OR MANUF? OR MFR# OR
 CREAT? OR FORM## OR FORMING# OR FORMAT? OR MAKE# OR
 MADE# OR MAKING# OR FABRICAT? OR SYNTHESI? OR PREPAR? OR
 PREP#)/BI,AB

FILE 'HCA' ENTERED AT 18:41:27 ON 10 MAY 2005

L39 15319 SEA (SO2 OR (SULFUR# OR SULFER# OR SULPHUR# OR SULPHER#) (W)DIOXIDE#) (2A) L38

L40 2056 SEA L37 AND (L4 OR L39)
 L41 132 SEA L40 AND L6
 L42 53 SEA L41 AND L8
 L43 0 SEA L41 AND L9
 L44 13 SEA L41 AND L12
 L45 4 SEA L44 AND L42
 L46 6 SEA L41 AND L26
 L47 24 SEA L14 OR L15 OR L16 OR L23 OR L25 OR L31 OR L45 OR L46
 L48 41 SEA (L22 OR L28 OR L33 OR L44) NOT L47
 L49 27 SEA (L24 OR L29) NOT (L47 OR L48)
 L50 24 SEA L47 AND (1900-2002/PY OR 1900-2002/PRY)
 L51 40 SEA L48 AND (1900-2002/PY OR 1900-2002/PRY)
 L52 24 SEA L49 AND (1900-2002/PY OR 1900-2002/PRY)

=> file hca

FILE 'HCA' ENTERED AT 18:59:29 ON 10 MAY 2005

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=> d l47 1-24 cbib abs hitstr hitind

L47 ANSWER 1 OF 24 HCA COPYRIGHT 2005 ACS on STN

137:386687 Process for **preparation** of **sulfur**

dioxide. Garcia, Javier Angel Perez (Chile). Eur. Pat.

Appl. EP 1262451 A2 20021204, 4 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR. (English). CODEN: EPXXDW.

APPLICATION: EP 2002-253829 20020530. PRIORITY: CL 2001-1267 20010531.

AB A process is provided for **prodn.** of **SO2** by
 combustion of S and **pure O2** in a closed system
 that produces a high yield in the **recovery** of **SO2**
 and that decreases environmental contamination to levels below the
 std. requirements. The **pure O2** is dild. before
 combustion in a recirculated combustion gas that was previously
 cooled to maintain combustion at <1,200.degree.. The combustion gas
 is cooled, purified, and liquefied, and the non-liquefied gas is
 recirculated in a closed system. A combustion gas having a high
SO2 content (e.g., 84 vol.% **SO2**) can thus be
 obtained, which is easily liquefied to a high **SO2**
recovery efficiency (e.g., 95% at -10.degree.). Preferably,
 S is smelted in a heat exchanger and burned with **O2** in a
 combustion chamber of a boiler. The combustion gas driven by

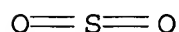
✓ US 6,875,413
 see (4 para B)

suction from a blower is cooled in a heat exchanger and a purifier/cooler. At a fork point, a portion of the gas is recirculated to a mixing point, where the **pure O2** is added. The remaining portion of the gas is liquefied in a cooling unit to **form liq. SO2**, leaving a non-condensable gaseous mixt. that is returned to the circuit via a mixing point.

IT **7446-09-5P, Sulfur dioxide, preparation**
(manuf. by combustion of sulfur with oxygen and subsequent liquefaction)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IT **7704-34-9, Sulfur, reactions 7782-44-7, Oxygen, reactions**
(manuf. by combustion of sulfur with oxygen and subsequent liquefaction)

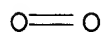
RN 7704-34-9 HCA

CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IC C01B017-54

CC 49-2 (Industrial Inorganic Chemicals)

ST **sulfur dioxide manuf liquefaction**

IT **7446-09-5P, Sulfur dioxide, preparation**
(manuf. by combustion of sulfur with oxygen and subsequent liquefaction)

IT **7704-34-9, Sulfur, reactions 7782-44-7, Oxygen, reactions**
(manuf. by combustion of sulfur with oxygen and subsequent liquefaction)

L47 ANSWER 2 OF 24 HCA COPYRIGHT 2005 ACS on STN

132:95268 Study on phosphorolysis of ammonium sulfite to produce

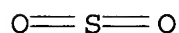
ammonium biphosphate and sulfur dioxide. Li, Wei; Xiao, Wende; Dai, Xiaoying (East China University of Science and Technology, Shanghai, 200237, Peop. Rep. China). Liusuan Gongye (5), 30-31 (Chinese) 1999. CODEN: LIGOEH. ISSN: 1002-1507. Publisher: Liusuan Gongye Bianjibu.

AB The prepn. of $(\text{NH}_4)_2\text{HPO}_4$ and SO_2 from byproduct SO_3 was studied by combining tail gas adsorption process of H_2SO_4 prodn. with $(\text{NH}_4)_2\text{HPO}_4$ prodn. Gas contg. 8-9% SO_2 was **returned** to H_2SO_4 prodn. The technol. can be used in most of phosphate fertilizer factories in China.

IT **7446-09-5P**, Sulfur dioxide, preparation
(prodn. of ammonium biphosphate and sulfur dioxide by phosphorolysis of ammonium sulfite)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



CC 49-5 (Industrial Inorganic Chemicals)

IT **7446-09-5P**, Sulfur dioxide, preparation 7722-76-1P,
Ammonium biphosphate
(prodn. of ammonium biphosphate and sulfur dioxide by phosphorolysis of ammonium sulfite)

L47 ANSWER 3 OF 24 HCA COPYRIGHT 2005 ACS on STN

131:201870 Synthesis of **liquid sulfur** trioxide with
high-purity oxygen at **atmosphere**

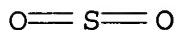
pressure. Zhao, Rubi; Shang, Shude; Cai, Chongji; Pan, Baoning (Nanjing Tianli Institute of Applied Chemical Technology, Peop. Rep. China). Faming Zhuanli Shenqing Gongkai Shuomingshu CN 1134396 A 19961030, 12 pp. (Chinese). CODEN: CNXXEV. APPLICATION: CN 1995-110962 19950309.

AB Liq. SO_3 is manufd. with 99.5% O_2 and **pure**
 SO_2 at atm. pressure. O_2 and **pure**
 SO_2 are introduced into a circulating system and mixed with circulating gas at room temp. and <0.03 MPa, the mixed gases are heat-exchanged with hot reacted gas from a converter to reach catalyst active reaction temp. and are reacted in the presence of V in the converter, the produced gas SO_3 is condensed into liq. SO_3 with H_2O and air in a condenser, uncondensed SO_3 gas and un-reacted **SO_2** gas are **recycled** to the reaction system.

IT **7446-09-5**, Sulfur dioxide, reactions
7782-44-7, Oxygen, reactions
(**synthesis** of **liq. sulfur trioxide**
with **high-purity oxygen** at atm.
pressure)

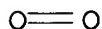
RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IC ICM C01B017-76

CC 49-8 (Industrial Inorganic Chemicals)

ST **sulfur trioxide liq** synthesis atm pressure

IT 7446-11-9P, **Sulfur trioxide**, preparation

(**liq.**; synthesis of **liq. sulfur trioxide** with high-purity oxygen at atm. pressure)

IT 7446-09-5, **Sulfur dioxide**, reactions

7782-44-7, **Oxygen**, reactions

(**synthesis** of **liq. sulfur trioxide** with high-purity oxygen at atm. pressure)

L47 ANSWER 4 OF 24 HCA COPYRIGHT 2005 ACS on STN

130:340471 Operation technology for COG desulfurization. Chang, Ben-Nan (Iron Refining Plant, China Steel Corp., Taiwan). Jishu Yu Xunlian, 24(1), 108-120 (Chinese) 1999. CODEN: CSYLDY. ISSN: 0254-5888. Publisher: China Steel Corp..

AB To comply with increasingly strict environmental stds., the Phase 3 coal chem. plant of CSC was erected om 1993, by Still-Otto company (Germany); previous plants (Phases 1 and 2) were erected in 1995. Currently these 2 plants are in smooth operation and successfully minimized SOx emissions produced by COG (coke-oven gas) combustion. The desulfurization plants of all three plants use a modified Claus process to remove potential pollutants and recover sulfur. After scrubbing NH3, H2 S, and HCN from the crude COG, these compds. are stripped out by steam in a distn. unit and sent to a decompn. oven and a Claus reactor, equipped with different solid catalysts, in which the NH3, H2S, HCN, CnHm are burned and converted to N2, H2, CO2, H2O, SO2, and **molten sulfur**. The produced waste gases, together with N2, H2, CO2, H2O, and traces of H2S and **SO2** are **returned** to suction mains of COG stream for rescrubbing. The entire process is operated in a closed-loop to prevent release into the atm., and the purified COG is sent downstream for combustion. The SOx emissions are <300 ppm.

CC 51-19 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 49

L47 ANSWER 5 OF 24 HCA COPYRIGHT 2005 ACS on STN
118:127705 Process for the manufacture of high-purity **sulfur dioxide** by oxidation of **molten sulfur** with oxygen.. Schendel, Ronald L. (Braun, C. F., Inc., USA). Eur. Pat. Appl. EP 524017 A1 19930120, 13 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, MC, NL, PT, SE. (English). CODEN: EPXXDW. APPLICATION: EP 1992-306589 19920717. PRIORITY: US 1991-732110 19910718.

AB The process comprises combusting **molten S** with an O-contg. **gas**, passing the S(g)-contg. gaseous effluent through a 1st cooling zone to cool the effluent to >600.degree., sepg. the S(l) from the vapor, and returning the S(l) to the combustion chamber.

IT 7704-34-9, Sulfur, reactions
(combustion of molten, submerged, with **oxygen-contg. gas**, for high-purity **sulfur dioxide**)

RN 7704-34-9 HCA

CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7782-44-7
(combustion, submerged, of **molten sulfur**, with **oxygen-contg. gas**, for high-purity **sulfur dioxide**, recycling of condensed **molten sulfur** in)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

(**gases** contg., submerged combustion with, of **molten sulfur**, for high-purity **sulfur dioxide**)

IT 7446-09-5P, Sulfur dioxide, preparation
(manuf. of high-purity, by submerged combustion of **molten sulfur** with **oxygen-contg. gas**)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IC ICM C01B017-54
CC 49-2 (Industrial Inorganic Chemicals)
ST **molten sulfur** submerged combustion oxygen;
sulfur dioxide sulfur oxidn oxygen
IT Recycling
(of **molten sulfur**, in high-purity
sulfur dioxide manuf. by submerged
combustion of **molten sulfur** with
oxygen-contg. gas)
IT Oxidation
(submerged, of **molten sulfur**, with
oxygen-contg. gas, for high-purity
sulfur dioxide, recycling of
condensed **molten sulfur** in)
IT Combustion
(submerged, of **molten sulfur**, with
oxygen-contg. gas, for high-purity
sulfur dioxide, recycling of
condensed **molten sulfur** in)
IT 7704-34-9, Sulfur, reactions
(combustion of molten, submerged, with **oxygen-contg.**
gas, for high-purity **sulfur dioxide**)
IT 7782-44-7
(combustion, submerged, of **molten sulfur**,
with **oxygen-contg. gas**, for high-purity
sulfur dioxide, recycling of
condensed **molten sulfur** in)
IT 7782-44-7, Oxygen, uses
(**gases** contg., submerged combustion with, of
molten sulfur, for high-purity **sulfur**
dioxide)
IT 8004-13-5, Dowtherm
(heat transfer fluid, in high-purity **sulfur**
dioxide manuf. by submerged combustion of
molten sulfur with **oxygen-contg.**
gas and recycling of condensed **molten**
sulfur)
IT 7446-09-5P, Sulfur dioxide,
preparation
(manuf. of high-purity, by submerged combustion of
molten sulfur with **oxygen-contg.**
gas)

L47 ANSWER 6 OF 24 HCA COPYRIGHT 2005 ACS on STN

113:209248 Changes in hemoglobin concentration and oxygen saturation in healthy and inflamed human gingivae following brushing. Hanioka, Takashi; Nagata, Hideki; Murakami, Yukitaka; Shizukuishi, Satoshi (Fac. Dent., Osaka Univ., Osaka, 530, Japan). Koku Eisei Gakkai

Zasshi, 40(2), 224-31 (Japanese) 1990. CODEN: KEGZA7. ISSN: 0023-2831.

- AB Hb concn. (Hb index) and oxygen satn. (SO2 index) in papillary gingivae were assayed using a noninvasive tissue reflectance spectrophotometer. Measurements were made before and continuously after brushing in a standardized manner. In healthy gingivae, the Hb index increased by 30-40% and then decreased by 10-20% from baseline within the first 5 min after the release of pressure from brushing. The SO2 index increased significantly between 1 and 30 min after brushing. The Hb index and SO2 index **returned** to baseline within 60 and 90 min after brushing, resp. In inflamed gingivae, changes in the Hb index and the SO2 index showed patterns similar to those in healthy gingivae. The Hb index reached min. level of 10 min after brushing and did not recover during the monitoring period. A significant increase in SO2 index was obsd. between 5 and 10 min after brushing. In conclusion, tooth brushing caused a rapid increase followed by a decrease in Hb concn. and an increase in oxygen satn. in gingivae, and these microvascular responses occurred slowly in inflamed gingivae.
- IT 7782-44-7, Oxygen, biological studies
(Hb satn. with, of gingivae, tooth brushing effect on, inflammation in relation to, in humans)
- RN 7782-44-7 HCA
- CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O—O

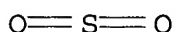
- CC 14-7 (Mammalian Pathological Biochemistry)
Section cross-reference(s): 13
- IT 7782-44-7, Oxygen, biological studies
(Hb satn. with, of gingivae, tooth brushing effect on, inflammation in relation to, in humans)
- L47 ANSWER 7 OF 24 HCA COPYRIGHT 2005 ACS on STN
- 113:81555 Sulfur recovery from elementary sulfur-containing material. Bielz, Siegfried; Fitting, Arno (Metallgesellschaft A.-G., Germany). Ger. Offen. DE 3900069 A1 19900705, 7 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1989-3900069 19890103.
- AB The title process comprises treating the s-contg. material in a recirculating fluidized bed with O-free hot **gas** to evap. the S, charging the bed with S-contg. material having particle size <3 mm, and, alter desensitizing the S-contg. gas, condensing the S from the gas, and purging some of the S-free gas, heating the remaining part of the S-free gas in a fluidized-bed cooler by indirect heat transfer with hot combustion gases and recirculating the heated gas as primary gas to the fluidized bed, while controlling the temp. in the heat exchanger such that the av.

temp. of the gas in the fluidized bed is .gtoreq.50.degree. higher than the deriv. point of the S-contg. carrier gas. This method gives max. S yield at min. heat energy consumption.

IT 7704-34-9P, Sulfur, preparation
(recovery of, from elementary sulfur-contg. material, carrier gas recirculation in)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5P, Sulfur dioxide,
preparation
(sulfur recovery from, by evapn. in recirculating fluidized bed)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM C01B017-027
ICS B01J008-24
ICA B01D053-34
CC 49-1 (Industrial Inorganic Chemicals)
ST sulfur evapn fluidized bed; heat exchange gas fluidized bed
IT 7664-93-9P, Sulfuric acid, preparation
(manuf. of, in sulfur-recovery from elementary sulfur -contg. material, fluidized bed-evapn. in)
IT 7704-34-9P, Sulfur, preparation
(recovery of, from elementary sulfur-contg. material, carrier gas recirculation in)
IT 7446-09-5P, Sulfur dioxide,
preparation 7783-06-4P, Hydrogen sulfide, preparation
(sulfur recovery from, by evapn. in recirculating fluidized bed)

L47 ANSWER 8 OF 24 HCA COPYRIGHT 2005 ACS on STN

111:60738 Comparing regenerative sulfur dioxide sorbents using thermogravimetry: the SRO [sulfation, regeneration, oxidation] test. Duisterwinkel, A. E.; Doesburg, E. B. M.; Hakvoort, G. (Lab. Phys. Chem., Delft Univ. Technol., Delft, 2628 BL, Neth.). Thermochimica Acta, 141, 51-9 (English) 1989. CODEN: THACAS. ISSN: 0040-6031.

AB Several synthetic Ca aluminates and titanates, as sorbents for regenerative desulfurization in the fluidized-bed combustion. of

coal were investigated by thermogravimetry for their sulfation, regeneration, and cyclic behavior. The SRO test, as a rapid and reliable test for screening sorbents, is superior to pilot plant testing because of the smaller size samples, which permits a more flexible exptl. approach, esp. for long-term behavior.

IT 7782-44-7

(combustion, fluidized-bed, of coal, sulfur dioxide removal in, calcium aluminate and calcium titanate as regenerative sorbents for)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7446-09-5, Sulfur dioxide, uses and miscellaneous

(removal of, in fluidized-bed coal combustion, calcium aluminate and calcium titanate as regenerative sorbents in)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

CC 51-18 (Fossil Fuels, Derivatives, and Related Products)

IT Sorbents

(calcium aluminate and calcium titanate, for sulfur dioxide, in fluidized-bed coal combustion)

IT 7782-44-7

(combustion, fluidized-bed, of coal, sulfur dioxide removal in, calcium aluminate and calcium titanate as regenerative sorbents for)

IT 7446-09-5, Sulfur dioxide, uses and miscellaneous

(removal of, in fluidized-bed coal combustion, calcium aluminate and calcium titanate as regenerative sorbents in)

L47 ANSWER 9 OF 24 HCA COPYRIGHT 2005 ACS on STN

110:176146 Sulfur recovery from hydrogen sulfide containing stream.

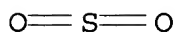
Palm, John W. (Amoco Corp., USA). U.S. US 4798716 A 19890117, 9 pp. Cont. of U.S. Ser. No. 857,009, abandoned. (English). CODEN: USXXAM. APPLICATION: US 1987-134574 19871207. PRIORITY: US 1984-605498 19840430; US 1986-857009 19860429.

AB A process for the recovery of S from a gaseous stream contg. H₂S comprises (a) introducing a thermal reaction mixt. of H₂S-contg. gaseous stream and an O-rich air stream or pure O

into a combustion zone of a Claus furnace, (b) producing hot combustion gases comprising H₂S, SO₂, CO₂, H₂O, and S, (c) introducing the combustion gases into a Claus catalytic reactor, (d)

producing a Claus plant gaseous effluent stream comprising H₂S, SO₂, CO₂, H₂O, and S, (e) producing liq. S, which is recovered, and a gaseous condenser effluent, (f) converting all S species in the gaseous condenser effluent to H₂S, (g) removing H₂O in the condenser effluent by condensation, and (h) moderating the temp. in the furnace by using part of the dried condenser effluent from (g) as diluent which is returned to step (a). The temp. of the combustion zone of the furnace, in the absence of the diluent streams is >2600 .degree.F. The total diluent/O mol ratio is 1:10 to 10:1. Thus, an acid gas comprising 67 mol% H₂S and 33 mol% CO₂ and a stream of 95.5 mol% O and 5 mol% N were introduced into a Claus furnace. The calcs. indicated that the overall S recovery was significantly increased and furnace and reactor temps. were decreased.

IT 7446-09-5, Sulfur dioxide, uses and miscellaneous
(sulfur manuf. from, by Claus process, diln. in, for decreased
temps.)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM C01B017-04
INCL 423574000R
CC 49-9 (Industrial Inorganic Chemicals)
IT 7446-09-5, Sulfur dioxide, uses and miscellaneous
(sulfur manuf. from, by Claus process, diln. in, for decreased
temps.)

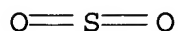
L47 ANSWER 10 OF 24 HCA COPYRIGHT 2005 ACS on STN

109:213173 Sulfur recovery from Claus plant tail gas using regenerable metal oxide absorbent. McGalliard, Russell L. (Amoco Corp., USA). U.S. US 4769229 A 19880906, 9 pp. (English). CODEN: USXXAM. APPLICATION: US 1986-912023 19860925.

AB The title process comprises adding ZnO-based absorbent to an absorber to produce a laden (sulfided) absorbent (ZnS) and a gaseous stream contg. decreased S compd. concns. The ZnO absorbent is regenerated in a regenerator by withdrawing a portion of the gaseous stream upstream of the absorber, blending it with an O-contg. stream, and allowing this gaseous mixt. to come in contact with the laden ZnO absorbent. The regeneration effluent stream comprising mainly SO₂ is returned to the Claus S-recovery plant. Use of absorber feed as a source of diluent for O during regeneration decreases the absorption rate in the absorber, allowing regeneration to be conducted at a lower rate, decreases the recycle rate of regenerator effluent to the Claus plant, and increases the concn. of S and S compds. Alternatively, the decrease in absorption

rate is advantageously translated into decrease in the size of the absorber required.

IT 7446-09-5P, Sulfur dioxide, preparation
(formation of, in regeneration of zinc oxide absorbent for
cleaning Claus tail gas)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



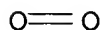
IC ICM C01B017-04
ICS B01D053-34
INCL 423574000R
CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 47
IT 7446-09-5P, Sulfur dioxide, preparation
(formation of, in regeneration of zinc oxide absorbent for
cleaning Claus tail gas)

L47 ANSWER 11 OF 24 HCA COPYRIGHT 2005 ACS on STN

108:223876 Improved sulfur recovery process from Claus tail gas using
metal oxide absorbent. Pendergraft, Paul Thomas; Lee, Min Hsiun
(Amoco Corp., USA). Eur. Pat. Appl. EP 260798 A2 19880323, 24 pp.
DESIGNATED STATES: R: AT, BE, CH, DE, ES, FR, GB, IT, LI, LU, NL,
SE. (English). CODEN: EPXXDW. APPLICATION: EP 1987-306861
19870803. PRIORITY: US 1986-893111 19860804.

AB The tail gas from a Claus plant is fed to an addnl. Claus catalytic
reaction zone operated under suitable conditions (160-330.degree.F)
for depositing a major portion of the S on the Claus catalyst. The
stream exiting the zone is then introduced into a 1st absorption
zone contg. ZnO absorbent, to produce a sulfided absorbent and an
effluent gas. The effluent and stoichiometric amt. of O₂ are then
introduced into a 2nd absorption zone for a period, during which ZnS
is converted to ZnO. The effluent from this stage comprising
SO₂ is returned to the Claus plant. The process
greatly reduces the vol. of the regeneration effluent returned to
the Claus plant for reprocessing and, hence, achieves significant
economic benefits.

IT 7782-44-7, Oxygen, uses and miscellaneous
(in sulfur recovery, from Claus tail gas)
RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IC ICM B01D053-34

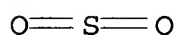
ICS C01B017-04
CC 49-1 (Industrial Inorganic Chemicals)
IT 7782-44-7, Oxygen, uses and miscellaneous
(in sulfur recovery, from Claus tail gas)

L47 ANSWER 12 OF 24 HCA COPYRIGHT 2005 ACS on STN
91:61950 Tail gas oxidation. Matsuda, Shinpei; Imahashi, Jinichi; Kato, Akira; Nakajima, Fumito (Babcock-Hitachi K. K., Japan). Jpn. Kokai Tokkyo Koho JP 54032168 19790309 Showa, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1977-97770 19770817.

AB S compds. in tail gas from S-recovery unit is oxidized with O in the presence of a catalyst to SO₂ which is subsequently scrubbed with a Na, K, or NH₄ sulfite soln. The O is added (1-2)-times of its stoichiometric amt. The catalyst consists of .gtoreq.50% TiO₂ and balance .gtoreq.1 oxides of Mo, W, Cr, V, Fe, Co, Ni, Cu, or Bi. The spent scrubbing soln. is heated to **recover SO₂** which is **returned** to the S-recovery units. The method is useful in the Claus process. Thus, metatitanic acid-NH₄ molybdate tablets were heated at 450.degree. to prep. TiO₂-MoO₃ catalyst of Ti-to-Mo at. ratio 9. A gas contg. H₂S 1, O₂ 2, H₂O 30%, and balance N was passed through the catalyst at 300.degree.. The SO₂ formation was >99% and **SO₂ recovery** from a sulfite soln. was >90%.

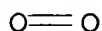
IT 7446-09-5P, preparation
(formation in recycle of, in hydrogen sulfide catalytic oxidn. in Claus tail-gas)

RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IT 7782-44-7, reactions
(oxidn. by, of hydrogen sulfide in Claus tail-gas, catalysts for)

RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IC B01D053-34
CC 59-2 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 49
IT Waste gases
(Claus tail-gas, hydrogen sulfide oxidn. in, **sulfur dioxide recycle** from, oxygen and catalyst in)

IT 7446-09-5P, preparation
(formation in recycle of, in hydrogen sulfide catalytic oxidn. in

Claus tail-gas)

- IT 7782-44-7, reactions
(oxidn. by, of hydrogen sulfide in Claus tail-gas, catalysts for)

L47 ANSWER 13 OF 24 HCA COPYRIGHT 2005 ACS on STN

90:170916 Highly concentrated **sulfur dioxide** from sulfur. Mukhlenov, I. P.; Soroko, V. E.; Vasil'ev, B. T.; Bartov, A. T.; Borisov, V. M.; Vorotnikov, A. G.; Egorov, P. A.; Ilgisonis, I.; Kuzichkin, N. V.; et al. (Leningrad Technological Institute, USSR). U.S.S.R. SU 644725 19790130 From: Otkrytiya, Izobret., Prom. Obraztsy, Tovarnye Znaki 1979, (4), 76. (Russian). CODEN: URXXAF. APPLICATION: SU 1975-2120938 19750404.

AB To **manuf.** high-concn. **SO2** by reaction of **pure O** with **S** vapor at a decreased temp., the **O** is bubbled through the **melt** at the **S** boiling temp., and the vapors are oxidized in a fluidized layer of an inert material or catalyst, and both stages are carried out at 1-35 atm.

IT 7446-09-5P, preparation
(manuf. of high-concn., sulfur evapn. in oxygen for)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IT 7782-44-7, uses and miscellaneous
(sulfur vaporization into, for high-concn. **sulfur dioxide manuf.**)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IC C01B017-54

CC 49-2 (Industrial Inorganic Chemicals)

ST **sulfur dioxide manuf**; oxidn sulfur

IT 7446-09-5P, preparation

(manuf. of high-concn., sulfur evapn. in oxygen for)

IT 7782-44-7, uses and miscellaneous

(sulfur vaporization into, for high-concn. **sulfur dioxide manuf.**)

IT 7704-34-9, uses and miscellaneous

(vaporization of, into oxygen, for high-concn. **sulfur dioxide manuf.**)

L47 ANSWER 14 OF 24 HCA COPYRIGHT 2005 ACS on STN

86:194411 Apparatus and method for separation and recovery of sulfur

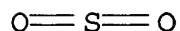
dioxide from waste gases. Duvall, Lee Joseph (USA). Ger. Offen. DE 2631444 19770224, 21 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1976-2631444 19760713.

AB The process involves cooling and compressing the waste gases sufficiently to liquefy the SO₂ and H₂O in the gases. The liquefied SO₂ and H₂O are then sepd. from the gases by proper control of the temp. and pressure. Part of the sepd. SO₂ is **returned** to the system to aid in the sepn.

IT 7446-09-5P, preparation
(recovery of, from waste gas by cooling and compressing)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC B01D005-00

CC 59-2 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 49

ST sulfur dioxide recovery waste gas; **liquefied**
sulfur dioxide recovery

IT 7446-09-5P, preparation
(recovery of, from waste gas by cooling and compressing)

L47 ANSWER 15 OF 24 HCA COPYRIGHT 2005 ACS on STN

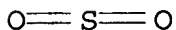
85:7844 **Sulfur dioxide** from sulfur and oxygen.
(Hoechst A.-G., Fed. Rep. Ger.). Ger. Offen. DE 2433231 19760129, 9 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1974-2433231 19740711.

AB SO₂ is **made** by the simultaneous combustion of com. pure O₂ and finely distributed liq. S without diln. by SO₂ at mole ratio O₂/S = 1.0-1.55 and 1-7 bar. Thus, 90 kg/hr liq. S and 92-96 kg/hr O₂ (excess 3-7%) are burned in a circular nozzle burner with an attached cooling coil and asbestos lining. Max. flame temp. is 1950.degree., temp. of combustion chamber wall 1400.degree., and gas temp. after cooling 280.degree.. The product contained 0.13-1.78 vol.% SO₃, depending of the O₂ excess.

IT 7446-09-5P, preparation
(from liq. sulfur, by combustion with oxygen)

RN 7446-09-5 HCA

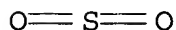
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC C01B

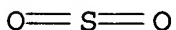
CC 49-3 (Industrial Inorganic Chemicals)
ST sulfur burning **sulfur dioxide**
IT 7446-09-5P, preparation
(from **liq. sulfur**, by combustion with oxygen)

L47 ANSWER 16 OF 24 HCA COPYRIGHT 2005 ACS on STN
84:140191 Sulfur removal from hydrogen sulfide-poor waste gases. LUCAS process. Bratzler, Karl; Doerges, Alexander; Schlauer, J. (Forschungslab., Lurgi Mineraloeltech. G.m.b.H., Frankfurt/Main, Fed. Rep. Ger.). Erdoel und Kohle, Erdgas, Petrochemie vereinigt mit Brennstoff-Chemie, 29(1), 19-22 (German) 1976. CODEN: EKVBAK. ISSN: 0367-0716.
AB Tail gases from Claus plants contg. <299 ppm SO₂ [7446-09-5] and H₂S [7783-06-4] were incinerated with low surplus of air, treated in a coke reactor at 380.degree. to reduce SO₃ to SO₂ and to remove H₂S, and treated with Na₂HPO₄ soln. to absorb SO₂. The concd. **SO₂** released was **returned** to the Claus plant or catalytically reduced to S.
IT 7446-09-5P, uses and miscellaneous
(recovery of, from waste gases, by Lucas process)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



CC 59-4 (Air Pollution and Industrial Hygiene)
IT 7446-09-5P, uses and miscellaneous
(recovery of, from waste gases, by Lucas process)

L47 ANSWER 17 OF 24 HCA COPYRIGHT 2005 ACS on STN
84:21693 Treatment of waste gas from Claus process. Tsuruta, Hidemasa (Nittetsu Chemical Engineering Ltd., Japan). U.S. US 3895101 19750715, 6 pp. (English). CODEN: USXXAM. APPLICATION: US 1974-477511 19740607.
AB Claus process tail gas was heated at 600.degree. with a 1.5 ratio of air and oxidized by combustion in the presence of (NH₄)₂SO₄ [7783-20-2] soln. The SO₂ [7446-09-5] formed in the tail gas was absorbed in (NH₄)₂SO₃ [10196-04-0] soln., which was then heated. The liberated **SO₂** was **returned** to the process and the NH₄ sulfite was recycled.
IT 7446-09-5P, preparation
(from Claus tail gas)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC C01B
INCL 423574000
CC 59-2 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 49
IT 7446-09-5P, preparation
(from Claus tail gas)

L47 ANSWER 18 OF 24 HCA COPYRIGHT 2005 ACS on STN
78:99846 High-pressure process for sulfur dioxide and sulfuric acid.
Kojima, Shoji; Brauder, T. J., Jr. (Mamehara Manufg., Inc.; Parsons,
Ralph M., Co. of Asia). Jpn. Tokkyo Koho JP 47032506 B4 19720819
Showa, 4 pp. (Japanese). CODEN: JAXXAD. APPLICATION: JP
1970-121275 19701229.
AB **Liq. S, pure O, and a**
diluent of recycled SO₂, at >6 atm was continuously converted to
10-95% SO₂ at 1204-1442.degree. in a combustion chamber. The SO₂
was partly liquefied by cooling and the remainder (10-14% SO₂) was
rapidly converted to SO₃ over a V catalyst with >99% efficiency; the
high O/SO₂ ratio of >6 reduced the initial reaction temp. to
370.degree. and reduced the amt. of catalyst consumed to 1/7 that
originally needed. Absorbents were unnecessary and air pollution
was reduced.
IT 7446-09-5P, preparation
(continuous high-pressure process for)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

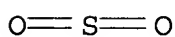
O=S=O

IC C01B
CC 49-2 (Industrial Inorganic Chemicals)
IT 7446-09-5P, preparation 7664-93-9P, preparation
(continuous high-pressure process for)

L47 ANSWER 19 OF 24 HCA COPYRIGHT 2005 ACS on STN
76:74337 Use of oxygen for combustion of sulfur in the process of
sulfur dioxide liquid production
. Banczyk, Leon; Wesolowski, Juliusz; Grobelny, Aleksander (Inst.
Chem. Nieorg., Zakl. Kwasu Siarkowego, Lubon/Poznan, Pol.).
Przemysl Chemiczny, 50(12), 818-21 (Polish) 1971. CODEN: PRCHAB.
ISSN: 0033-2496.
AB Pilot plant expts. on the **production** of liq. SO₂
by the combustion of S in O₂, involving the
purification of the reaction gases by absorbing SO₃ in
concd. H₂SO₄, followed by condensation of the unabsorbed SO₂
, are discussed. The quality of the final product meets the stds.

required of **SO2** used in the manuf. of food products.

IT **7446-09-5P**, preparation
(from sulfur, absorption of sulfur trioxide and condensation in)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



CC 49 (Industrial Inorganic Chemicals)
Section cross-reference(s): 17

ST **sulfur dioxide liq**

IT Absorption
(of **sulfur** trioxide, in **liq. sulfur**
dioxide manuf.)

IT **7446-09-5P**, preparation
(from sulfur, absorption of sulfur trioxide and condensation in)

L47 ANSWER 20 OF 24 HCA COPYRIGHT 2005 ACS on STN

74:89216 Sulfur from gases containing hydrogen sulfide. Wernicke, Hans J.; Reitzenstein, Hermann (Messer Griesheim G.m.b.H.; Friedrich Uhde GmbH). Ger. Offen. DE 1941703 19710304, 9 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1969-1941703 19690816.

AB The Claus process for the S manuf. is extended to gas mixts. contg. <15 -20% H2S. Thus, **SO2 generated** by combustion of **liq. S** with O or an O-rich **gas** in a jet burner reacts with the H2S-contg. initial gas mixt. at 1:2 **SO2** -H2S ratio in the mixing chamber of a steam boiler to give .apprx.70% S (with respect to S introduced) which after condensation is drawn off. The residual gases are conducted through 2 reaction chambers in series to give 100% conversion **liq. S** part of which is **recycled** to the **SO2 generation**.

IT **7704-34-9P**, preparation
(from hydrogen sulfide, with double auxiliary contact furnace)

RN 7704-34-9 HCA

CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IC C01B

CC 49 (Industrial Inorganic Chemicals)

IT **7704-34-9P**, preparation
(from hydrogen sulfide, with double auxiliary contact furnace)

L47 ANSWER 21 OF 24 HCA COPYRIGHT 2005 ACS on STN

54:43909 Original Reference No. 54:8566f-g Obtaining sulfur dioxide

from high-furnace slag. Jicinsky, Jaroslav; Zajic, Miloslav; Juranek, Jan CS 90967 19590715 (Unavailable). APPLICATION: CS .

AB Blowing O or a mixt. of O with air through a **liquid** S-contg. slag yields SO₂, which is absorbed and worked up as usual.

IT 7446-09-5, Sulfur dioxide
(manuf. of, from S-contg. slags by blowing with air-O mixt. or O)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IT 7782-44-7, Oxygen
(**sulfur dioxide recovery** from slags
by blowing with)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

CC 9 (Metallurgy)

IT 7446-09-5, Sulfur dioxide
(manuf. of, from S-contg. slags by blowing with air-O mixt. or O)

IT 7782-44-7, Oxygen
(**sulfur dioxide recovery** from slags
by blowing with)

L47 ANSWER 22 OF 24 HCA COPYRIGHT 2005 ACS on STN

52:96963 Original Reference No. 52:17012h-i,17013a-b Processing high-phosphorus and high-sulfur-containing charges in the basic electric-arc furnace by using **pure oxygen**.

Ludemann, Karl Friedrich (Met. Inst. Freiberg/Sachsen, Germany). Frieburger Forschungsh., B26, 16-36 (Unavailable) 1958.

AB The possibility of direct processing of bloomery loops to steel (in East Germany) was investigated. Three modes were tried: (1) melting nonalloyed. C-poor steels in the elec. arc furnace with **pure O** under gradual increase of the proportion of bloomery loops in the charge from 31 to 57%; (2) investigation of the possibility of fast dephosphonization and desulfurization in elec.-arc furnace melts with more than 90% bloomery loop charge, and (3) testing the steels obtained from bloomery loop melts with regard to their mech. properties and toughness, especially at low temps. The equipment, methods of investigation and compn. of the materials used are described in detail. Two melts with about 90% bloomery loops charge could be dephosphorized in a short time to very low final values, while the desulfurization was insufficient. The

desulfurization during the **application** of **O** goes on in 2 stages: the usual desulfurization characterized by the passage of the **S** from the steel melt into the lime-phosphate slag, and the direct combustion of the **S** of the **melt** by the **introduced O** with **formation** of **SO2**. In the presence of slags oversatd. with lime a rough desulfurization to 0.04-0.09% can be obtained, so that an addnl. fine desulfurization is necessary. Notch-impact toughness and mech. properties of steels made with different bloomery loop charges (steels St 42 and MSt 4) were not inferior to open-hearth steel of similar compn. Al-killed steels of the former type are both cold-proof and aging-resistant. 20 references.

CC 9 (Metallurgy and Metallography)

L47 ANSWER 23 OF 24 HCA COPYRIGHT 2005 ACS on STN
46:50066 Original Reference No. 46:8335c-d Sulfuric acid and **liquid sulfur** dioxide manufactured from smelter gases at Copper Cliff, Ontario. Allgood, R. W. (Can. Inds. Ltd., Copper Cliff, ON). Transactions - the Canadian Institute of Mining and Metallurgy and the Mining Society of Nova Scotia, 55, From: Can. Mining Met. Bull. No. 479, 153-5 (Unavailable) 1952. CODEN: TCIMAT. ISSN: 0371-5701.

AB Detailed tech. description of 150 ton/day contact H2SO4 plant. Liquid SO2 will be produced from 75% SO2 gas resulting from "flash-smelting" of ore concentrates with O instead of air.

IT 7782-44-7, Oxygen
(in copper smelting with **SO2 recovery**)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7446-09-5, **Sulfur dioxide**
(**liquid**, manuf. from smelter gases)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

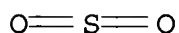
CC 18 (Acids, Alkalies, Salts, and Other Heavy Chemicals)

IT 7782-44-7, Oxygen
(in copper smelting with **SO2 recovery**)

IT 7446-09-5, **Sulfur dioxide**
(**liquid**, manuf. from smelter gases)

L47 ANSWER 24 OF 24 HCA COPYRIGHT 2005 ACS on STN

42:30575 Original Reference No. 42:6501d-e **Liquid**
sulfur dioxide and oleum. Danti, Mario IT 412747 19460216
(Unavailable). APPLICATION: IT .
AB **Melted S** is burned under pressure with
pure O. The heat of the reaction is utilized by a
special boiler. Thereafter, SO₂ is vaporized and mixed with O for
SO₃ production. The process is recommended for its room saving.
IT **7446-09-5, Sulfur** dioxide
(**liquid**, manuf. of, and oxidation thereof to SO₃)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



CC 18 (Acids, Alkalies, Salts, and Other Heavy Chemicals)
IT **7446-09-5, Sulfur** dioxide
(**liquid**, manuf. of, and oxidation thereof to SO₃)

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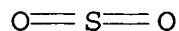
L51 ANSWER 1 OF 40 HCA COPYRIGHT 2005 ACS on STN
140:341674 Method for the automated manufacture of pure SO₂ from sulfur
and oxygen. Labrana, Valdivia Oscar David; Hanke, Altmann Hans
(Quimetal Industrial S.A., Chile). U.S. Pat. Appl. Publ. US
2004086451 A1 20040506, 10 pp. (English). CODEN: USXXCO.
APPLICATION: US 2003-601600 20030624. PRIORITY: CL 2002-2545
20021106.

AB Liq. SO₂ having a purity of >99.9% is produced by an automated
process from elemental sulfur and **pure oxygen**,
in the presence of SO₂ recirculated from the closed circuit prodn.
system itself. The temp. of the sulfur is controlled by pre-defined
S, O₂ and SO₂ ratios. The automation is made based on oxygen
sensors and on sulfur and SO₂ flow meters with their resp. control
connections and proportional valves permitting a fine control of the
sulfur combustion reaction. The sulfur is entered into the
combustion chamber at 130-135.degree. maintained by a steam produced
in a multistep heat exchanger post-combustion chamber. The
combustion chamber is maintained at preferably 1160.+-.50.degree..
The liquefaction of the gaseous SO₂ produced is carried out
alternatively by a cool plant working between -10 and -60.degree. or
with a compression unit working at a pressure between 3.8 and 5.0
bar. Small amts. of SO₃ formed during combustion are removed by
countercurrent absorption in a 98% H₂SO₄ tower. The automation
permits an optimum temp. control and a clean prodn. of SO₂.

IT **7446-09-5P, Sulfur** dioxide, preparation
(automated manuf. of pure SO₂ from sulfur and oxygen)

(Whit case)

RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM C01B017-54
INCL 423543000
CC 49-8 (Industrial Inorganic Chemicals)
Section cross-reference(s): 47
IT 7446-09-5P, Sulfur dioxide, preparation
(automated manuf. of pure SO₂ from sulfur and oxygen)

L51 ANSWER 2 OF 40 HCA COPYRIGHT 2005 ACS on STN

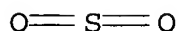
139:9120 Power generation in **oxygen-enriched atmosphere** with flue gas recirculation for reduced air pollution and liquefied gas byproducts. Hsu, Justin Chin-Chung (USA). U.S. US 6574962 B1 20030610, 8 pp. (English). CODEN: USXXAM. APPLICATION: US 2001-990360 20011123.

AB An integrated conceptual power plant burns fuel in an **oxygen-enriched gas stream** in a combustion furnace and converts air pollutant emissions and carbon dioxide into byproducts. The combustion gas stream, after leaving an economizer of a steam generation system, is split into two streams, stream A and stream B. Stream A recirculates back to the combustion furnace through the first flue gas recirculation fan for combustion temp. control. Stream B, after passing through a dust collector for fly ash removal, a series of condensers for byproduct recovery, and the second flue gas recirculation fan, mixes with an **oxygen-enriched stream** from an air sepn. unit and flows back to the combustion furnace. The plant does not need an exhaust stack and does not discharge combustion gases into the atm. The byproduct condensers sep. out and condense NO₂, CO₂, and SO₂. First-stage combustion is carried out in a water-wall combustion furnace, a refractory-wall combustion furnace, or a conventional combustion furnace, using coal, wood, refuse-derived fuel, fossil fuels, natural gas, or any combustible waste as fuel. The dust and acid gas removal system includes a wet cyclone, a wet multiple-cyclone collector, a dry cyclone, a dry multiple-cyclone collector, a packed bed absorber, a venturi scrubber, a baghouse, or an electrostatic precipitator.

IT 7446-09-5P, Sulfur dioxide, preparation
(liq., recovery of; power generation in oxygen-enriched atm. with flue gas recirculation for reduced air pollution and liquefied gas byproducts)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM F01K025-06

INCL 060649000; 060651000; 060671000

CC 51-12 (Fossil Fuels, Derivatives, and Related Products)

Section cross-reference(s): 59, 60

IT Filters

(bags; power generation in **oxygen-enriched atm**
. with flue gas recirculation for reduced air pollution and
liquefied gas byproducts)

IT Flue dust

(capture and removal of; power generation in **oxygen**
-enriched **atm.** with flue gas recirculation for reduced
air pollution and liquefied gas byproducts)

IT Municipal refuse

Wood waste

(combustion of; power generation in **oxygen-enriched**
atm. with flue gas recirculation for reduced air
pollution and liquefied gas byproducts)

IT Natural gas, processes

(combustion of; power generation in **oxygen-enriched**
atm. with flue gas recirculation for reduced air
pollution and liquefied gas byproducts)

IT Steam

(generation of; power generation in **oxygen-enriched**
atm. with flue gas recirculation for reduced air
pollution and liquefied gas byproducts)

IT Cyclone separators

(of flue dust; power generation in **oxygen-enriched**
atm. with flue gas recirculation for reduced air
pollution and liquefied gas byproducts)

IT Scrubbing

(of flue gases; power generation in **oxygen-enriched**
atm. with flue gas recirculation for reduced air
pollution and liquefied gas byproducts)

IT Combustion

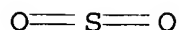
(of fossil fuels and wastes, in **oxygen-enriched**
atm.; power generation in **oxygen-enriched**
atm. with flue gas recirculation for reduced air
pollution and liquefied gas byproducts)

IT Electrostatic precipitation apparatus

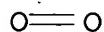
Power

(power generation in **oxygen-enriched atm.**
with flue gas recirculation for reduced air pollution and
liquefied gas byproducts)

- IT Combustion gases .
(recirculation of; power generation in **oxygen-enriched atm.** with flue gas recirculation for reduced air pollution and liquefied gas byproducts)
- IT 124-38-9P, Carbon dioxide, preparation **7446-09-5P, Sulfur dioxide, preparation**
10102-44-0P, Nitrogen dioxide, preparation
(**liq., recovery** of; power generation in **oxygen-enriched atm.** with flue gas recirculation for reduced air pollution and liquefied gas byproducts)
- L51 ANSWER 3 OF 40 HCA COPYRIGHT 2005 ACS on STN
138:225760 Method and apparatus for processing of combustion products. Akchurin, Kh. I.; Yazovtsev, V. V.; Klimin, O. V.
(Spetsializirovannaya Organizatsiya po Proektirovaniyu, Montazhu i Naladke Gazoispol'zuyushchego i Kotel'nogo Oborudovaniya, Russia). Russ. RU 2183984 C1 **20020627**, No pp. given (Russian).
CODEN: RUXXE7. APPLICATION: RU 2000-129300 20001122.
- AB The app. contains following components located in succession along a gas-and-water passage: a contact condenser or a contact-surface condenser, a degasifier, a supply compressor, and a cryst. hydrator which has circulation loops for an initial soln. and cold and hot heat-transfer agents. The forced circulation loop for the initial soln. is connected to the degasifier through the supply compressor and to a gas reservoir and is provided with a compressor. The forced circulation loop for the heat-transfer agents is connected to atm. air and includes a compressor and autonomous sources of cold and heat. Waste gases are absorbed in the condenser at such pressure when the condensation temp. of H₂O(g) is equal to 90-100.degree.; a condensate is degassed in the degasifier at atm. pressure; condensation of H₂O(g) and adsorption of sepd. gases are effected in the cryst. hydrator by means of the initial soln.; the cryst. hydrates of each agent are formed due to change and control of temp. and pressure of the initial soln.; the cryst. hydrates are melted, and pure substances thus obtained are sepd. from water. The arrangement provides an enhanced economical efficiency. Concd. H₂SO₄ and HNO₃, pure CO₂ and SO₂, N₂, and O₂ are recovered from the combustion products. The system is suitable for cleaning of flue gases in boilers, industrial furnaces, and thermal engines operating with gaseous, liq., and org. fuels.
- IT **7446-09-5P, Sulfur dioxide, preparation**
7782-44-7P, Oxygen, preparation
(**recovery** in processing of flue gases)
- RN 7446-09-5 HCA
- CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

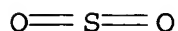


RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



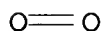
- IC ICM B01D053-14
CC 59-4 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 49, 52
ST flue gas treatment sulfuric acid recovery; nitric acid recovery flue gas treatment; carbon dioxide recovery flue gas treatment; nitrogen recovery flue gas treatment; **sulfur dioxide recovery** flue gas treatment; oxygen recovery flue gas treatment
IT 124-38-9P, Carbon dioxide, preparation **7446-09-5P**, **Sulfur dioxide**, preparation 7664-93-9P, Sulfuric acid, preparation 7697-37-2P, Nitric acid, preparation 7727-37-9P, Nitrogen, preparation **7782-44-7P**, Oxygen, preparation
(**recovery** in processing of flue gases)
- L51 ANSWER 4 OF 40 HCA COPYRIGHT 2005 ACS on STN
137:48842 Selective oxidesulfurization of Cl-organosulfur compounds over supported metal oxide catalysts. Choi, Sukwon; Wachs, Israel E. (ZCSS and Department of Chemical Engineering, Lehigh University, Bethlehem, PA, 18015, USA). Preprints of Symposia - American Chemical Society, Division of Fuel Chemistry, 47(1), 138-139 (English) 2002. CODEN: PSADFZ. ISSN: 1521-4648.
Publisher: American Chemical Society, Division of Fuel Chemistry.
- AB A catalytic process scheme was developed to convert byproducts from the pulp and paper mills to feedstocks. A key intermediate reaction step is the selective catalytic oxidn. of Cl-organosulfur compds. (COS). The kinetics and mechanism were studied of the selective oxidn. of COS, CS₂ and CH₃SH over sulfur-tolerant vanadia (V₂O₅) catalysts. The catalysts were prep'd. by the incipient wetness impregnation of supports TiO₂, ZrO₂, Nb₂O₅, CeO₂, Al₂O₃, and SiO₂. The turnover frequency for COS and CS₂ oxidn. varied by about one order of magnitude depending on the support, in the order CeO₂ > ZrO₂ > TiO₂ > Nb₂O₅ > Al₂O₃ - SiO₂. All reactions exhibited a zero-order dependence on the oxygen partial pressure.
- IT **7446-09-5P**, Sulfur oxide (SO₂), preparation
(selective oxidative desulfurization of organosulfur compds. over metal oxide supported vanadia catalysts for recovery of chem. feedstocks in the paper industry)

RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IT 7782-44-7, Oxygen, reactions
(selective oxidative desulfurization of organosulfur compds. over metal oxide supported vanadia catalysts for recovery of chem. feedstocks in the paper industry)

RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)
Section cross-reference(s): 43, 67

ST organosulfur compd selective oxidesulfurization vanadia catalyst oxide support; **sulfur dioxide recovery**
pulpig byproduct feedstock manuf; selective oxidesulfurization organosulfur compd pulpig feedstock manuf

IT 7446-09-5P, Sulfur oxide (SO₂), preparation
(selective oxidative desulfurization of organosulfur compds. over metal oxide supported vanadia catalysts for recovery of chem. feedstocks in the paper industry)

IT 74-93-1, Methanethiol, reactions 75-15-0, Carbon disulfide, reactions 7704-34-9D, Sulfur, org. compds. 7782-44-7, Oxygen, reactions
(selective oxidative desulfurization of organosulfur compds. over metal oxide supported vanadia catalysts for recovery of chem. feedstocks in the paper industry)

L51 ANSWER 5 OF 40 HCA COPYRIGHT 2005 ACS on STN

135:36558 Process for recovering sulfur compounds from waste gases. Watson, Richard William; Gravilles, Stephen Rhys (BOC Group PLC, UK). Eur. Pat. Appl. EP 1106572 A2 **20010613**, 9 pp.
DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 2000-310452 20001124. PRIORITY: GB 1999-29330 19991210.

AB Sulfur is recovered from a 1st gas stream comprising hydrogen sulfide and at least 50 vol.% of ammonia and from a 2nd gas stream comprising hydrogen sulfide but essentially no ammonia, the 1st gas stream, the 2nd gas stream, and combustion supporting gas comprising at least one stream of essentially **pure oxygen** or **oxygen**-enriched air are fed to a single combustion zone or a plurality of combustion zones in parallel with each other

without premixing of combustible gas with oxygen or air, and creating in the or each combustion zone at least one region in which thermal cracking of ammonia takes place, and taking from the reactor an effluent gas stream including sulfur vapor, sulfur dioxide, and hydrogen sulfide, but essentially no residual ammonia.

IT 7446-09-5P, Sulfur dioxide, processes
(process for recovering sulfur compds. from waste gases)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IC ICM C01B017-04
CC 59-4 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 49
IT 7446-09-5P, Sulfur dioxide, processes 7704-34-9DP, Sulfur, compds., processes 7704-34-9P, Sulfur, processes 7783-06-4P, Hydrogen sulfide (H₂S), processes
(process for recovering sulfur compds. from waste gases)

L51 ANSWER 6 OF 40 HCA COPYRIGHT 2005 ACS on STN
134:233995 Apparatus generating oxygenated chemical radicals and industrial applications thereof. Calone-Bonneau, Marguerite Gabrielle (Bordeau, Philippe, Fr.). PCT Int. Appl. WO 2001018188 A2 20010315, 22 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (French). CODEN: PIXXD2. APPLICATION: WO 2000-FR2438 20000905. PRIORITY: FR 1999-11314 19990907.

AB The invention concerns a novel app. for enzymic prodn. of oxygenated free chem. radicals in liq. or gas form specifically adapted to various industrial purposes. The app. comprising a sealed chamber contg. immobilized enzymes of plant, microbial or animal origin, belonging to the oxidoreductase group. The device, after various oxygen-contg. chem. compns. and enzyme substrates have been introduced into the chamber, enables the generation of a concd. and continuous flux of oxygenated free chem. radicals and oxidized substrates having biocidal activity. Said biocidal products are applied, in liq. or gas form and in sufficient concn. levels, for decontaminating food products (milk and milk products, meat, fruits and vegetables, beverages), for cleaning and disinfecting equipment (containers, tools, machines, fabrics, packages) and industrial

premises, for detoxication and sanitizing water and air, and for destructive treatment of org. waste.

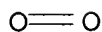
IT 7446-09-5P, Sulfur dioxide, biological studies
(app. generating oxygenated chem. radicals and industrial applications thereof)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IC ICM C12N011-00
CC 9-1 (Biochemical Methods)
Section cross-reference(s): 7, 17, 59, 60, 61
IT Air **purification**
Apparatus
Disinfectants
Wastewater treatment
(app. generating **oxygenated** chem. radicals and industrial applications thereof)
IT 3170-83-0P, Hydroperoxyl radical 3352-57-6P, Hydroxyl radical, biological studies 7446-09-5P, Sulfur dioxide, biological studies 7446-11-9P, Sulfur trioxide, biological studies 7790-92-3P, Hypochlorous acid 10028-15-6P, Ozone, biological studies 10102-43-9P, Nitric oxide, biological studies 10102-44-0P, Nitrogen dioxide, biological studies 10544-73-7P, Dinitrogen trioxide 11062-77-4P, Superoxide anion 14691-52-2P, Peroxynitrous acid 15181-46-1P 19059-14-4P, Peroxynitrite 63296-34-4P, Cyanosulfoxylate 80475-45-2P, Cyanosulfite 80475-46-3P, Cyanosulfate
(app. generating oxygenated chem. radicals and industrial applications thereof)

L51 ANSWER 7 OF 40 HCA COPYRIGHT 2005 ACS on STN
131:245214 Apparatus for manufacturing sulfuric acid. Kamenoen, Shoichi (Ishikawajima-Harima Heavy Industries Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 11263607 A2 19990928 Heisei, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1998-63227 19980313.
AB In the manuf. of sulfuric acid by combusting sulfur to give SO₂, oxidizing SO₂ to SO₃, and adsorbing SO₃ by dil. H₂SO₄, the app. comprises means for supplying combustion-supporting gas such as O₂ into the combustion furnace, circulating lines for directing the exhaust gas from adsorption tower into combustion furnace, and means for **recovering** SO₂ exited from the combustion furnace and using its energy as electricity source.
IT 7782-44-7, Oxygen, processes
(app. for manufg. sulfuric acid comprising means for supplying)
RN 7782-44-7 HCA

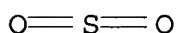
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IT 7446-09-5P, Sulfur dioxide, preparation
(generation of sulfur oxides in manufg. sulfuric acid as driving
power sources)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM C01B017-74

CC 49-2 (Industrial Inorganic Chemicals)

ST sulfuric acid manuf exhaust gas circulating line; **sulfur
dioxide energy recovery**; oxygen supplying line
sulfuric acid manuf app

IT 7782-44-7, Oxygen, processes

(app. for manufg. sulfuric acid comprising means for supplying)

IT 7446-09-5P, Sulfur dioxide, preparation

(generation of sulfur oxides in manufg. sulfuric acid as driving
power sources)

L51 ANSWER 8 OF 40 HCA COPYRIGHT 2005 ACS on STN

131:186980 Apparatus and method for purification of sulfur dioxide.

Koda, Hideyuki; Kajiwara, Yuji; Okawa, Jun (Sumitomo Seika K. K.,
Japan). Jpn. Kokai Tokkyo Koho JP 11228114 A2 19990824
Heisei, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP
1998-24128 19980205.

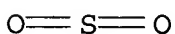
AB SO₂ gas contg. impurities and unreacted S and O₂ is
purified by sepg. S from the SO₂ feed gas by cooling,
liquefying the treated SO₂, further sepg. S by distn. under
pressure, cooling the gas contg. SO₂ and O₂ obtained from the top of
the distn. column, and sepg. SO₂ from O₂ by cooling. High-purity
SO₂ gas is manufd. at low cost with high efficiency.

IT 7446-09-5P, Sulfur dioxide, preparation

(app. and method for purifn. of sulfur dioxide)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM C01B017-56

CC 49-8 (Industrial Inorganic Chemicals)

ST sulfur dioxide **purifn oxygen** removal app

IT 7446-09-5P, Sulfur dioxide, preparation
(app. and method for purifn. of sulfur dioxide)

L51 ANSWER 9 OF 40 HCA COPYRIGHT 2005 ACS on STN

121:38635 A new process for oxygen generation step for the hydrogen producing sulfur-iodine thermochemical cycle. Oeztuerk, I. T.; Hammache, A.; Bilgen, E. (Ec. Polytech., Univ. Montreal, Can.). Chemical Engineering Research and Design, 72(A2), 241-50 (English) 1994. CODEN: CERDEE. ISSN: 0263-8762.

AB A new design, and thermodyn. and engineering analyses of the H₂SO₄ decompn. section of the S-I thermochem. cycle for producing H is described. Excess O is used as heat transfer fluid in various direct contact adiabatic equipment. Shell and tube heat exchangers are eliminated as much as possible. Thermodyn. (energy and exergy) and cost analyses were carried out. Energetic and exergetic efficiencies are 64.2 and 64.0%, resp. and typical cost is \$3.3 (1990)/kmol SO₂, for \$4 U.S. (1990)/GJ nuclear heat cost.

IT 7782-44-7P, Oxygen, preparation
(manuf. of, in sulfur-iodine thermochem. cycle with nuclear heat source, in added step)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7446-09-5P, Sulfur dioxide, reactions
(recovery and reaction of, in sulfur-iodine thermochem. cycle, for sulfuric acid regeneration)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

CC 49-1 (Industrial Inorganic Chemicals)

Section cross-reference(s): 71

IT 7782-44-7P, Oxygen, preparation

(manuf. of, in sulfur-iodine thermochem. cycle with nuclear heat source, in added step)

IT 7446-09-5P, Sulfur dioxide, reactions

(recovery and reaction of, in sulfur-iodine thermochem. cycle, for sulfuric acid regeneration)

L51 ANSWER 10 OF 40 HCA COPYRIGHT 2005 ACS on STN

118:151482 Converting of copper, nickel, and copper-nickel mattes in horizontal unit. Shalygin, L. M.; Bumazhnov, F. T.; Smirnov, Yu. M.; Savva, V. P.; Gul'tyaev, S. V.; Galushko, O. Ya.; Serebryany,

Ya. L.; Seregin, S. Ya.; Kondyrev, E. S.; et al. (Leningrad Mining Institute, USSR). U.S.S.R. SU 1721109 A1 19920323 From: Izobreteniya 1992, (11), 90. (Russian). CODEN: URXXAF. APPLICATION: SU 1990-4780479 19900109.

AB Molten matte, cold feed, and quartz flux are charged into a horizontal converter, and the resulting sulfide melt is blown with continuous removal of SO₂-contg. gases and periodic removal of slag. Productivity is increased and wear of refractories is prevented for decreased process cost by blowing through 2 layers of tuyeres situated below and above the melt. The lower tuyeres are used for blowing with air or low-O₂ gas mixes. The upper tuyeres are situated at 40-50.degree. angle from the melt surface, and are used for blowing with enriched air contg. 21-50% O₂ and fed at 15-30% of total. Conc'n. of the SO₂ in exit gas is increased.

IT 7782-44-7, Oxygen, reactions
(oxidn. with, of molten mattes in horizontal converter, two levels of tuyeres for blowing control in)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7446-09-5P, Sulfur dioxide, preparation
(recovery of, from matte converters, oxygen blowing control for)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IC ICM C22B015-06

CC 54-2 (Extractive Metallurgy)

IT 7782-44-7, Oxygen, reactions
(oxidn. with, of molten mattes in horizontal converter, two levels of tuyeres for blowing control in)

IT 7446-09-5P, Sulfur dioxide, preparation
(recovery of, from matte converters, oxygen blowing control for)

L51 ANSWER 11 OF 40 HCA COPYRIGHT 2005 ACS on STN

117:238970 System for removal of hydrogen sulfide from waste gases. Watson, Richard William (BOC Group PLC, UK). Eur. Pat. Appl. EP 500320 A1 19920826, 22 pp. DESIGNATED STATES: R: AT, BE, DE, FR, GB, IT, NL, SE. (English). CODEN: EPXXDW. APPLICATION: EP 1992-301321 19920218. PRIORITY: GB 1991-3382 19910219.

AB H₂S-contg. waste gases are preheated in a heat exchanger and portion

of the H₂S is burnt in a furnace to form SO₂ and water vapor; **pure O** or O-enriched air is used to support combustion. The SO₂ reacts with the residual H₂S to form further water vapor and a S vapor which is removed from the waste gas in a condenser. The waste gas stream is then divided into 1st and 2nd subsidiary streams. The H₂S content of the 1st subsidiary stream is totally converted to SO₂ in an incinerator using **pure O** or O-enriched air to support its combustion. Water vapor is removed from the 1st subsidiary stream in the condenser and the resulting SO₂-rich gas stream is recycled to the furnace. The 2nd subsidiary stream is subjected to a plurality of stages of catalytic reaction between H₂S and SO₂ to form further S vapor which is then removed.

IT 7446-09-5P, Sulfur dioxide, preparation
(formation of, in removal of hydrogen sulfide from waste gases)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

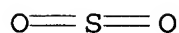
O=S=O

IC ICM C01B017-04
ICS B01D053-34
CC 59-4 (Air Pollution and Industrial Hygiene)
IT 7446-09-5P, Sulfur dioxide, preparation
(formation of, in removal of hydrogen sulfide from waste gases)

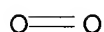
L51 ANSWER 12 OF 40 HCA COPYRIGHT 2005 ACS on STN
117:215584 Manufacture of sulfuric acid from oxygen and sulfur by noncatalytic process. Masseling, Jacobus J. H.; Netzer, David (Parsons, Ralph M., Co., USA). PCT Int. Appl. WO 9214678 A1 19920903, 32 pp. DESIGNATED STATES: W: AU, BR, CA, JP, KR, RU; RW: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LU, MC, NL, SE. (English). CODEN: PIXXD2. APPLICATION: WO 1992-US1435 19920224. PRIORITY: US 1991-661847 19910226; US 1991-785271 19911030; US 1991-793100 19911115.

AB O-rich gas stream contg. >75 vol.% O and a feed of **recycled SO₂** gas stream comprising >50 vol.% SO₂ are combusted at 700-1000.degree. and .ltoreq.35 kg/cm² to form a SO₃ gas stream contg. 5-15 vol.% SO₃, the SO₃-contg. gas stream is passed through a SO₃-absorption zone to form H₂SO₄ and to produce a SO₂-contg. gas stream which is compressed to form the **recycled SO₂** gas stream, and the H₂SO₄ is removed.
IT 7446-09-5P, Sulfur dioxide, preparation
(in noncatalytic manuf. of sulfuric acid, from oxygen and sulfur)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

*US cited in
Perez Garcia*



IT 7782-44-7, Oxygen, reactions
(reaction of, with sulfur, in noncatalytic manuf. of sulfuric acid)
RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



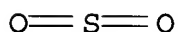
IC ICM C01B017-74
CC 49-2 (Industrial Inorganic Chemicals)
IT 7446-09-5P, Sulfur dioxide, preparation
(in noncatalytic manuf. of sulfuric acid, from oxygen and sulfur)
IT 7782-44-7, Oxygen, reactions
(reaction of, with sulfur, in noncatalytic manuf. of sulfuric acid)

L51 ANSWER 13 OF 40 HCA COPYRIGHT 2005 ACS on STN

115:186291 Sulfur recovery process for ammonia-containing feed gas.
Szekely, Andrew Geza (Union Carbide Industrial Gases Technology Corp., USA). Eur. Pat. Appl. EP 440141 A2 19910807, 9 pp.
DESIGNATED STATES: R: BE, DE, ES, FR, IT. (English). CODEN: EPXXDW. APPLICATION: EP 1991-101086 19910128. PRIORITY: US 1990-471973 19900129.

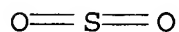
AB NH₃-contg. sour gas is combusted at high flame temp. with .gtoreq.90%-purity O in an externally cooled combustor, the NH₃-free product is cooled, then, in conjunction with addnl. acid gas which does not contain NH₃, is passed to a Claus furnace wherein <1/3 of the H₂S is combusted with O enriched air. enabling boosting S recovery in a Claus plant without detrimental effects on catalyst service life, furnace refractories and pressure drops.

IT 7446-09-5P, Sulfur dioxide, reactions
(reaction of, with hydrogen sulfide, for sulfur recovery from ammonia-contg. feed gas in Claus plant)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

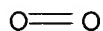


IC ICM C01B017-04
CC 49-1 (Industrial Inorganic Chemicals)
IT 7446-09-5P, Sulfur dioxide, reactions
(reaction of, with hydrogen sulfide, for sulfur recovery from

- ammonia-contg. feed gas in Claus plant)
- IT 7783-06-4P, Hydrogen sulfide, reactions
(reaction of, with **sulfur dioxide**, for sulfur
recovery from ammonia-contg. feed gas in Claus plant)
- L51 ANSWER 14 OF 40 HCA COPYRIGHT 2005 ACS on STN
112:222610 Sulfur recovery using metal oxide absorbent, e.g., zinc
oxide, with improved purge for treating Claus tail gas.
Pendergraft, Paul T. (Amoco Corp., USA). U.S. US 4871521 A
19891003, 14 pp. Cont. of U.S. Ser. No. 98,775, 'abandoned.
(English). CODEN: USXXAM. APPLICATION: US 1988-218526 19880706.
PRIORITY: US 1986-902248 19860828; US 1987-98775 19870918.
- AB S species, esp. H₂S, are removed from Claus plant tail gases by
contact with ZnO to form ZnS. The ZnS is regenerated with dil. O₂
and **SO₂** is **recovered**. The treated gas contains
.ltoreq.250 ppm of total residual H₂S and SO₂. To maintain high
removals, freshly regenerated ZnO is purged with an effective
reducing gas stream, producing SO₂ emissions which are treated
downstream in a second ZnO absorber to remove the SO₂.
- IT **7446-09-5P, Sulfur dioxide**, preparation
(**recovery** of, from zinc sulfide produced by hydrogen
sulfide removal from Claus waste gases by zinc oxide, zinc oxide
regeneration in)
- RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



- IT **7782-44-7, Oxygen**, uses and miscellaneous
(zinc oxide regeneration with, in removal of hydrogen sulfide
from Claus plant waste gases)
- RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



- IC ICM C01B017-16
ICS C01B031-20; C01B017-02
INCL 423230000
CC 59-4 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 49
- IT Waste gases
(from Claus plant, hydrogen sulfide removal from, with zinc
oxide, **sulfur dioxide recovery** in)
- IT **7446-09-5P, Sulfur dioxide**, preparation
(**recovery** of, from zinc sulfide produced by hydrogen

- sulfide removal from Claus waste gases by zinc oxide, zinc oxide regeneration in)
- IT 1314-13-2P, Zinc oxide, uses and miscellaneous
(removal of hydrogen sulfide from Claus plant waste gases with, **sulfur dioxide recovery** and zinc oxide regeneration in)
- IT 7783-06-4, Hydrogen sulfide, uses and miscellaneous
(removal of, from Claus plant waste gases with zinc oxide, **recovery of sulfur dioxide** and **regeneration** of zinc oxide in)
- IT 1314-98-3, Zinc sulfide, uses and miscellaneous
(zinc oxide and **sulfur dioxide recovery** from, in removal of hydrogen sulfide from Claus waste gases by zinc oxide)
- IT 7782-44-7, Oxygen, uses and miscellaneous
(zinc oxide regeneration with, in removal of hydrogen sulfide from Claus plant waste gases)
- L51 ANSWER 15 OF 40 HCA COPYRIGHT 2005 ACS on STN
112:219870 Sulfur recovery from sodium sulfate-containing wastes.
Meyer, Hermann; Pforr, Gerhard; Roemer, Rainer (BASF A.-G., Germany). Ger. Offen. DE 3829826 A1 **19900315**, 3 pp.
(German). CODEN: GWXXBX. APPLICATION: DE 1988-3829826 19880902.
- AB Wastes and wastewaters contg. Na₂SO₄ are reduced in the presence of O₂ or air at >1200.degree. to form gaseous S₂- and SO_x, as well as an alkali slag, using a coal dust, heavy fuel oil, natural gas, or H₂ furnace. The gaseous reaction products are then processed to S, SO₂, and H₂SO₄. Silicate additives may be used to improve the flow characteristics of the slag, which is then easily removed from the furnace, quenched in water, and used as a silicate building material.
- IT 7782-44-7, Oxygen, uses and miscellaneous
(in sulfur recovery from sodium sulfate-contg. wastes)
- RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

- IT 7446-09-5P, **Sulfur dioxide**, preparation
(**recovery** of, from sodium sulfate-contg. wastes by redn.)
- RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IC ICM C01B017-00
ICS C01B017-48; C04B018-04; C04B014-04
ICA B01D053-34
CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 58, 60
IT 7782-44-7, Oxygen, uses and miscellaneous
(in sulfur recovery from sodium sulfate-contg. wastes)
IT 7446-09-5P, Sulfur dioxide, preparation
7664-93-9P, Sulfuric acid, preparation 7704-34-9P, Sulfur,
preparation 12624-32-7P, Sulfur oxide
(recovery of, from sodium sulfate-contg. wastes by
redn.)

L51 ANSWER 16 OF 40 HCA COPYRIGHT 2005 ACS on STN
111:217419 Copper smelting by use of calcium ferrite slag and recycling
of high strength sulfur dioxide exhaust gas. Yazawa, A.; Acuna, C.
(Res. Inst. Miner. Dress. Metall., Tohoku Univ., Sendai, 980,
Japan). Copper 87 [Eighty-Seven], Meeting Date 1987, Volume 4,
305-17. Editor(s): Diaz, Carlos; Landolt, Carlos; Luraschi, Antonio
A. Univ. Chile, Fac. Cienc. Fis. Mat.: Santiago, Chile. (English)
1988. CODEN: 56OWA5.

AB The direct prodn. of white metal by smelting with Ca ferrite slag
and pure O with recycling of high-strength SO₂
exhaust gas was proposed on the basis of heat and material balances
and the exptl. data. In comparison to traditional smelting, this
process eliminates the requirement of fuel and reduces the amt. of
outlet gas and the heat losses considerably. These aspects result
in small and tight heat recovery and gas cleaning units. The
exhaust gas contains nearly pure SO₂. CaSO₃.0.5H₂O is produced from
gas cleaning system and used as flux.

IT 7446-09-5P, Sulfur dioxide, preparation
(from copper smelting to white metal with calcium ferrite slag,
utilization of)

RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

CC 54-2 (Extractive Metallurgy)
IT 7446-09-5P, Sulfur dioxide, preparation
(from copper smelting to white metal with calcium ferrite slag,
utilization of)

L51 ANSWER 17 OF 40 HCA COPYRIGHT 2005 ACS on STN
110:41376 Modified Claus process for sulfur recovery from oil refinery
waste gases. Watson, Richard William (BOC Group PLC, UK). Eur.
Pat. Appl. EP 290286 A2 19881109, 8 pp. DESIGNATED

STATES: R: AT, BE, DE, FR, IT, NL, SE. (English). CODEN: EPXXDW.
APPLICATION: EP 1988-304147 19880506. PRIORITY: GB 1987-10828
19870507.

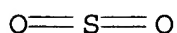
- AB In the title process, a 1st H₂S-contg. waste gas stream [e.g., sour water stripper (SWS) gas] is combusted in a 1st combustion chamber (FCC) using **pure O**; the combustion products are cooled in a heat exchanger, and a part of the product is recycled to the FCC to moderate the temp. The rest of the combustion product is mixed with a 2nd H₂S-contg. gas stream (e.g., a mixt. of SWS gas and "amine" gas) of different compn. from the 1st. A part of the H₂S in the mixed gas stream is combusted using **pure O**, and the resulting SO₂ reacts with residual H₂S to give S and H₂O. The process minimizes the vol. of "ballast" gas, e.g., N, which flows through the S recovery process. The process is described in detail with flow diagrams.
- IT **7446-09-5P**, Sulfur dioxide, preparation
(formation and reaction of, in sulfur recovery from waste gas by modified Claus process)
- RN 7446-09-5 HCA
- CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

- IC ICM C01B017-04
- CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 51, 59
- IT **7446-09-5P**, Sulfur dioxide, preparation
(formation and reaction of, in sulfur recovery from waste gas by modified Claus process)
- L51 ANSWER 18 OF 40 HCA COPYRIGHT 2005 ACS on STN
- 108:8279 Method and apparatus for **recovery** of a **sulfur dioxide**-containing gas mixture from a sulfate-containing waste material. Watson, Richard William (BOC Group PLC, UK). Eur. Pat. Appl. EP 244206 A2 **19871104**, 7 pp. DESIGNATED
STATES: R: BE, DE, ES, FR, IT, NL. (English). CODEN: EPXXDW.
APPLICATION: EP 1987-303760 19870428. PRIORITY: GB 1986-10856
19860502.
- AB Gas mixts. including **SO₂** are **recovered** from sulfate waste materials by burning a fuel to form a flame zone, introducing the waste into the flame zone, employing an O-rich gas, e.g., either O-rich air or **pure O**, to support combustion of the fuel and generate a flame of sufficient temp., 900-1300.degree., to thermally crack solid sulfate wastes and liberate SO₂ therefrom, and sepg. the solids exiting the flame zone from the gaseous combustion products. The sulfate waste is preconcd. by evapg. part of the water content. The burner is

disposed vertically or at an angle from the vertical, causing the solid cracking residues to drop by gravity. The collected residues are sent to a zone apart from the flame zone for addnl. thermal cracking. The SO₂ is converted to SO₃ which is absorbed in an aq. liq. to form H₂SO₄. The app. is equipped with means to perform all the processes described above.

IT 7446-09-5, Sulfur dioxide, reactions
(oxidn. of, from sulfate waste cracking, to trioxide for sulfuric acid manuf.)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM C01B017-58
CC 49-2 (Industrial Inorganic Chemicals)
Section cross-reference(s): 60
ST **sulfur dioxide recovery** sulfate waste
IT 7446-09-5, Sulfur dioxide, reactions
(oxidn. of, from sulfate waste cracking, to trioxide for sulfuric acid manuf.)

L51 ANSWER 19 OF 40 HCA COPYRIGHT 2005 ACS on STN
107:222346 Sulfur dioxide emissions from oil refineries and combustion of oil products in western Europe. De Meulemeester, A.; De Roocker, A.; Long, M.; Origoni, G. (CONCAWE, The Hague, Neth.). Report, CONCAWE-10/86; Order No. PB87-176921/GAR, 17 pp. Avail. NTIS From: Gov. Rep. Announce. Index (U. S.) 1987, 87(15), Abstr. No. 732,729 (English) 1986.

AB The survey for 1985 of the amt. of S received by refineries and its subsequent disposition, taken together with the earlier 1979 and 1982 surveys, illustrates the ongoing decrease in the oil industry's contribution to the S emission burden on the European environment. The data was extrapolated to compile an overall S mass balance for Western Europe. Input with crude oil and other feedstocks was evaluated against the refinery outputs through the S contents of oil products, the level of S **recovery**, and SO₂ emissions from refinery stacks. From 1979-1985 the S content of oil products for combustion fell by 62% and S emitted from refinery stacks decreased by 40%. The refinery contribution to total man-made SO₂ emissions continued to decrease and in 1985 it was 6.5%.

IT 7446-09-5P, Sulfur dioxide, biological studies
(air pollution by, from petroleum refining and combustion of petroleum products, in western Europe)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IT 7782-44-7

(combustion, of petroleum products, sulfur dioxide air pollution
in relation to, of western Europe)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7446-09-5

(petroleum refining, sulfur dioxide air pollution by in western
Europe)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

CC 59-2 (Air Pollution and Industrial Hygiene)

Section cross-reference(s): 51

IT 7446-09-5P, Sulfur dioxide, biological studies

(air pollution by, from petroleum refining and combustion of
petroleum products, in western Europe)

IT 7782-44-7

(combustion, of petroleum products, sulfur dioxide air pollution
in relation to, of western Europe)

IT 7446-09-5

(petroleum refining, sulfur dioxide air pollution by in western
Europe)

L51 ANSWER 20 OF 40 HCA COPYRIGHT 2005 ACS on STN

107:219900 Modified Claus process for sulfur recovery from hydrogen
sulfide-containing gas streams. Watson, Richard William (BOC Group
PLC, UK). Eur. Pat. Appl. EP 237217 A1 19870916, 11 pp.

DESIGNATED STATES: R: AT, BE, DE, FR, IT, NL, SE. (English).

CODEN: EPXXDW. APPLICATION: EP 1987-301517 19870220. PRIORITY: GB
1986-5650 19860307; GB 1987-2134 19870130.

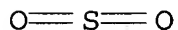
AB A feed gas stream contg. .gtoreq.60 vol% H₂S (I) is burnt, using
(preferably pure) O, in a 1st combustion region
(CR) to give water vapor and SO₂ (II). Reaction then takes place in
a thermal reaction region (TRR) between I and II to give S(g) and
water vapor; the resulting gas mixt. is cooled and the S is extd. in
a condenser. The mixt. then passes into a 2nd CR where further I is
burnt with O to give II and the I:II mol ratio is adjusted to

.apprx.2:1. Further reaction between I and II may be carried out in a TRR and in catalytic reactors with further S extn. in condensers. The mol ratio I:O entering the 2nd CR per unit time is >2:1 and the mol ratio the I to fluids other than O (if any) is >3:2, preferably >4:1. By using substantially **pure O** to support I combustion, a relatively large flow rate of feed-gas mixt. may be handled in a given plant.

IT 7446-09-5P, Sulfur dioxide, preparation
(formation and reaction of, in improved Claus process for hydrogen sulfide removal from gas streams)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM C01B017-04

ICS B01D053-34

CC 49-1 (Industrial Inorganic Chemicals)

Section cross-reference(s): 59

IT 7446-09-5P, Sulfur dioxide, preparation
(formation and reaction of, in improved Claus process for hydrogen sulfide removal from gas streams)

L51 ANSWER 21 OF 40 HCA COPYRIGHT 2005 ACS on STN

107:219899 Modified Claus process for sulfur recovery from hydrogen sulfide-containing gas stream. Watson, Richard William (BOC Group PLC, UK). Eur. Pat. Appl. EP 237216 A1 19870916, 12 pp.

DESIGNATED STATES: R: AT, BE, DE, FR, IT, NL, SE. (English).

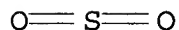
CODEN: EPXXDW. APPLICATION: EP 1987-301516 19870220. PRIORITY: GB 1986-5649 19860307; GB 1987-2132 19870130.

AB A gas stream contg. (typically) .gtoreq.70 vol.% H₂S (I) is divided into minor and major streams. The minor stream is burnt in a 1st combustion region (CR) to give SO₂ (II) and water vapor; the resulting gas mixt. is cooled and used in a 2nd CR where a portion of the I in the major stream is burnt. Reaction between the II and the remaining I takes place in a thermal reaction region to give S(g) and water vapor. The proportions of S burnt in the resp. CR's are chosen so that .apprx.1/3 of the total I content of the feed gas is converted to II in these regions. Subsequent reaction between I and II takes place in catalytic reaction regions with S(g) being extd. in condensers. By using substantially **pure O** to support combustion in the 2nd CR, a relatively large flow rate of feed gas may be handled in a given plant.

IT 7446-09-5P, Sulfur dioxide, preparation
(formation and reaction of, in hydrogen sulfide removal from gas streams, modified Claus process for)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM C01B017-04

ICS B01D053-34

CC 49-1 (Industrial Inorganic Chemicals)

Section cross-reference(s): 59

IT 7446-09-5P, Sulfur dioxide, preparation

(formation and reaction of, in hydrogen sulfide removal from gas streams, modified Claus process for)

L51 ANSWER 22 OF 40 HCA COPYRIGHT 2005 ACS on STN

106:122373 Treatment of gases. Watson, Richard William (BOC Group PLC, UK). Brit. UK Pat. Appl. GB 2173780 A1 19861022, 10 pp.

(English). CODEN: BAXXDU. APPLICATION: GB 1986-57 19860409.

PRIORITY: GB 1985-9393 19850412.

AB S is manufd. from gas streams contg. .gtoreq.50 vol.% H2S by burning a 1st portion of H2S with gas contg. .gtoreq.22 vol.% O to form SO2 and H2O, treating a 2nd portion of the H2S with the SO2, and controlling the reaction temp. by atomization of a noncombustible, vaporizable, e.g., water(l) or CO2(l), and/or a vaporized quenchant, e.g., a vapor contg. .gtoreq.80% steam, and condensing the resulting S. The O-contg. gas may be O-enriched gas or **pure**

O. Alternatively, the hot, e.g., 1100-1250.degree.,

reaction gases may be cooled in a heat exchanger or waste heat boiler before S is condensed. After S condensation, the gas mixt.

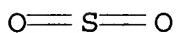
is subjected to .gtoreq.1 catalytic reaction for removal of residual H2S by the Claus reaction. After the 1st catalytic reaction the gas mixt. contains H2O(g) >80 and S-contg. gases >5 vol.%. The tail gas is treated to remove H2S and/or mixed with fuel gas for combustion.

IT 7446-09-5P, Sulfur dioxide, reactions

(reaction of, with hydrogen sulfide, in sulfur manuf. by Claus reaction)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM C01B017-04

ICS B01D053-34

CC 49-1 (Industrial Inorganic Chemicals)

IT 7446-09-5P, Sulfur dioxide, reactions

(reaction of, with hydrogen sulfide, in sulfur manuf. by Claus reaction)

L51 ANSWER 23 OF 40 HCA COPYRIGHT 2005 ACS on STN

106:104695 Method and catalytic reactor for conversion of hydrogen sulfide to sulfur. Heisel, Michael; Lohmueller, Reiner; Marold, Freimut (Linde A.-G., Fed. Rep. Ger.). Ger. Offen. DE 3526706 A1 19870129, 7 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1985-3526706 19850725.

AB The catalytic conversion of H₂S to S in gas streams is carried out by directing the preheated gas over an internally cooled, quasi-isothermal catalyst bed. The catalytic reactor contains .gtoreq.1 cooling devices.

IT 7782-44-7, Oxygen, reactions

(combustion of hydrogen sulfide by, in sulfur recovery from hydrogen sulfide-contg. gases)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

(combustion, of residual sulfur compds., to **sulfur dioxide**, in sulfur **recovery** form hydrogen sulfide-contg. gases)

IT 7446-09-5P, Sulfur dioxide, preparation

(formation and recycling of, in sulfur recovery from hydrogen sulfide-contg. gases)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IC ICM C01B017-04

CC 49-1 (Industrial Inorganic Chemicals)

Section cross-reference(s): 47

IT Combustion

(of residual sulfur compds., to **sulfur dioxide**, in sulfur **recovery** form hydrogen sulfide-contg. gases)

IT 7782-44-7, Oxygen, reactions

(combustion of hydrogen sulfide by, in sulfur recovery from hydrogen sulfide-contg. gases)

IT 7782-44-7

(combustion, of residual sulfur compds., to **sulfur dioxide**, in sulfur **recovery** form hydrogen sulfide-contg. gases)

IT 7446-09-5P, Sulfur dioxide, preparation

(formation and recycling of, in sulfur recovery from hydrogen sulfide-contg. gases)

L51 ANSWER 24 OF 40 HCA COPYRIGHT 2005 ACS on STN

106:88191 Converting matte in two converters. Leiponen, Matti Olavi (Outokumpu Oy, Finland). Pat. Specif. (Aust.) AU 553412 B2 19860717, 16 pp. (English). CODEN: ALXXAP. APPLICATION: AU 1982-90888 19821125.

AB Alternated blowing is applied in 2 converters for matte conversion treatment with a uniform gas flow, higher heating efficiency, and increased smelting capacity. Blowing of one converter is applied while the other one is charged with a high-grade matte from a flash-smelting furnace, or tilted for discharge of slag and crude metal (esp. Cu) products. Waste gas contg. SO₂ from the converters is fed to H₂SO₄-manufd. plant at a uniform rate. A single waste-heat boiler is used with both converters.

IT 7782-44-7, Oxygen, uses and miscellaneous
(converter blowing with gas contg., for matte smelting)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7446-09-5P, Sulfur dioxide, preparation
(recovery of, in converter matte smelting blowing
control of)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IC C01B017-74; C21C005-42; C22B015-06

CC 54-2 (Extractive Metallurgy)

Section cross-reference(s): 51

IT 7782-44-7, Oxygen, uses and miscellaneous
(converter blowing with gas contg., for matte smelting)

IT 7446-09-5P, Sulfur dioxide, preparation
(recovery of, in converter matte smelting blowing
control of)

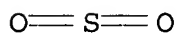
L51 ANSWER 25 OF 40 HCA COPYRIGHT 2005 ACS on STN

103:107515 Sulfur recovery in regeneration of iron desulfurization catalysts. (Central Research Laboratories for the Electric Power Foundation, Japan). Jpn. Kokai Tokkyo Koho JP 60060190 A2 19850406 Showa, 3 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1983-167943 19830912.

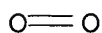
AB S is recovered in regeneration of Fe oxide coal gas desulfurization catalysts by sustaining the formation of sulfurous acid anhydride in

addn. of small amt. of O or air. Thus, 12.4 g S-contaminated Fe catalyst was contacted with 163 g/h steam (550.degree.) contg. 0.2% O and .apprx.30% of total S was recovered in 120 min as solid phase.

IT 7446-09-5P, preparation
(formation of, prevention of, by addn. of oxygen, in sulfur recovery in regeneration of iron catalysts)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IT 7782-44-7, uses and miscellaneous
(in prevention of **sulfur dioxide** formation, in **recovery** of sulfur, in regeneration of iron catalyst)
RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



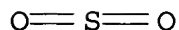
IC ICM C10K001-26
CC 51-20 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 49
IT 7446-09-5P, preparation
(formation of, prevention of, by addn. of oxygen, in sulfur recovery in regeneration of iron catalysts)
IT 7782-44-7, uses and miscellaneous
(in prevention of **sulfur dioxide** formation, in **recovery** of sulfur, in regeneration of iron catalyst)

L51 ANSWER 26 OF 40 HCA COPYRIGHT 2005 ACS on STN
103:24454 Antimony sesquioxide production. Zellner, Robert J.
(McGean-Rohco, Inc., USA). U.S. US 4515765 A 19850507, 4
pp. (English). CODEN: USXXAM. APPLICATION: US 1983-564926
19831223.

AB Sb2O3 is manufd. by burning powd. Sb2S3 in **pure O2**
. The combustion products, Sb2O3 and SO2 are quenched to below the b.p. of Sb2O3 to condense the Sb2O3 which is sepd. from the SO2. The SO2 is cooled and liquefied. A device is described for **recycling** the cooled **SO2** for cooling the SO2 plus Sb2O3 combustion products.

IT 7446-09-5P, preparation
(manuf. of, antimony sulfide combustion with **pure oxygen** in)
RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC C01B027-00

INCL 423617000

CC 49-10 (Industrial Inorganic Chemicals)

IT 1309-64-4P, preparation **7446-09-5P**, preparation
(manuf. of, antimony sulfide combustion with **pure oxygen** in)

L51 ANSWER 27 OF 40 HCA COPYRIGHT 2005 ACS on STN

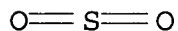
100:148362 Photochemistry of argon matrixes containing nitric oxide and carbonyl sulfide. 1. The photolysis of the nitric oxide dimer, cis-N₂O₂. Hawkins, Michael; Downs, Anthony J. (Inorg. Chem. Lab., Univ. Oxford, Oxford, OX1 3QR, UK). Journal of Physical Chemistry, 88(8), 1527-33 (English) 1984. CODEN: JPCHAX. ISSN: 0022-3654.

AB Irradn. at .lambda. = 220-320 nm causes the cis isomer of the NO dimer isolated in an Ar matrix at 13-20 K to photodissoc. to N₂O and O atoms. The photochem. behavior is interpreted in terms of the structure and bonding of cis-[NO]₂ and comparisons are made with predictions based on ab initio CI and CNDO/S calcns. The O atoms are obsd. to react with CO, OCS, NO, and cis-[NO]₂ under these conditions and there is evidence for 2 conformers of the product sym-N₂O₃. Concurrent photolysis of OCS in Ar/OCS/NO matrixes leads to products characteristic of S atom transfer including **S₂** and **regenerated** OCS. The use of isotropic enrichment to identify products yielded direct evidence in support of the cage-recombination mechanism for the matrix reaction of S atoms with O₂.

IT **7446-09-5P**, preparation
(formation of, in photolysis of argon matrix contg. nitric oxide and carbonyl sulfide)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

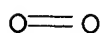


IT **7782-44-7**, reactions

(photolysis of, in argon matrix contg. carbonyl sulfide and)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)



- CC 74-1 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
- IT 7446-09-5P, preparation 56971-19-8P
(formation of, in photolysis of argon matrix contg. nitric oxide and carbonyl sulfide)
- IT 7782-44-7, reactions 32767-18-3, reactions
(photolysis of, in argon matrix contg. carbonyl sulfide and)
- L51 ANSWER 28 OF 40. HCA COPYRIGHT 2005 ACS on STN
97:96012 Oxygen smelting of copper concentrate with exhaust **sulfur dioxide gas recycling**. Yazawa, Akira; Tozawa, Kazuteru (Res. Inst. Miner. Dress. Metall., Tohoku Univ., Sendai, Japan). Journal of Metals, 34(3), 39-44 (English) 1982. CODEN: JOMTAA. ISSN: 0022-2674.
- AB The use of O in Cu smelting decreases dust and heat loss by reducing the quantity of exhaust gas. An O-smelting process (Senken) with exhaust **SO2 recycling**, produces >60% Cu matte and the amts. of heat and gas are 62 and 28%, resp., of those of a conventional process. The furnace shaft is low, and mixed O-SO2 are introduced after preheating to 800 K. A small vol. of high-SO2 exhaust gas is produced which is treated by use of a waste heat boiler. Cu concns. with a CuFeS2 compn. are smelted by 50% O-SO2 gas to produce 67% Cu matte, which is converted continuously with the 50/50 O-SO2 gas.
- IT 7782-44-7, uses and miscellaneous
(in smelting of copper, **sulfur dioxide recycling** in relation to)
- RN 7782-44-7 HCA
- CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

- IT 7446-09-5P, preparation
(**recycling** of, in oxygen smelting of copper concs.)
- RN 7446-09-5 HCA
- CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

- CC 54-2 (Extractive Metallurgy)
- IT 7782-44-7, uses and miscellaneous
(in smelting of copper, **sulfur dioxide recycling** in relation to)
- IT 7440-50-8P, preparation
(recovery of, by smelting in shaft furnace, **sulfur**

dioxide recycling in)

IT 7446-09-5P, preparation

(recycling of, in oxygen smelting of copper concs.)

L51 ANSWER 29 OF 40 HCA COPYRIGHT 2005 ACS on STN

95:64515 Method of producing sulfuric acid. Mukhlenov, I. P.; Soroko, V. E.; Vasiliev, B. T.; Bartov, A. T.; Borisov, V. M.; Vorotnikov, A. G.; Egorov, P. A.; Ilgisonis, I. V.; Kuzichkin, N. V.; et al. (Leningrad Technological Institute, USSR; Scientific-Research Institute of Fertilizers and Insectofungicides). Brit. GB 1585869 19810311, 7 pp. (English). CODEN: BRXXAA. APPLICATION: GB 1977-46082 19771104.

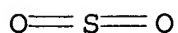
AB H₂SO₄ is manufd. by catalytically oxidizing SO₂ in a fluidized bed, withdrawing heat from the bed using a heat exchanger, converting the SO₃ from the product gas mixt. into H₂SO₄, and returning part of the gas mixt. contg. unreacted SO₂, excess O, and inert gas to the oxidn. stage via an injector. A gas mixt. contg. SO₂ is supplied to the injector from an app. for converting S or S-contg. material into SO₂, under a pressure higher than that in the circulation system (5-12 atm). The excess O at the entry to the circulation system relative to the stoichiometric amt. necessary for SO₂ oxidn. is .ltoreq.1.5%. Preferably, the SO₂ is obtained by bubbling O through molten S at 120-150.degree. and oxidizing the S vapor at 2-35 atm in a fluidized bed of inert material or wear-resistant catalyst. Thus, a mixt. contg. SO₂ 65.5, O 34.0, and inert gases 0.5 vol. % was delivered at 15 atm and 650.degree. into an injector where it was mixed with circulating gas to give a compn. contg. SO₃ 0.04, SO₂ 49.2, O 37.94, and N 12.82 vol. %. The mixt. was fed at 10 atm into a fluidized bed of V₂O₅ catalyst for oxidn. at 450-550.degree.. The product gases were fed into app. where SO₃ was absorbed in H₂SO₄ at 70-250.degree. to give a gas mixt. contg. SO₃ 0.14, SO₂ 14.89, O 46.17, and inert gas 38.8 vol. %, 681 kg/h of which was withdrawn and the remainder recycled. The excess heat was used to generate steam at 440.degree. and 40 atm. The process yielded 2364 tons H₂SO₄/day at 99.7% SO₂ conversion.

IT 7446-09-5P, reactions

(prepn. and oxidn. of, in sulfuric acid manuf.)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC C01B017-77

CC 49-2 (Industrial Inorganic Chemicals)

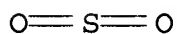
- ST sulfuric acid manuf; **sulfur dioxide** oxidn
sulfuric acid
- IT Oxidation
(of **sulfur dioxide**, in sulfuric acid manuf.,
gas recycling in)
- IT 7664-93-9P, preparation
(manuf. of, by fluidized-bed oxidn. of **sulfur
dioxide**, gas **recycling** in)
- IT 7446-09-5P, reactions
(prepn. and oxidn. of, in sulfuric acid manuf.)
- L51 ANSWER 30 OF 40 HCA COPYRIGHT 2005 ACS on STN
94:213461 Decreasing sulfur dioxide emissions from Inco Metals Company's
Copper Cliff smelter. Warner, J. Stuart (Occup. Health Enviro. Inco
Ltd., ON, Can.). Proceedings of the Ontario Industrial Waste
Conference, 27th, 138-53 (English) 1980. CODEN: OIWPAP.
ISSN: 0078-4893.
- AB SO₂ pollution control at the title Cu and Ni smelter is described,
including (1) magnetic sepn. of pyrrhotite from the ore and thus
removal of it from the Ni conc.; (2) roasting the sepd. pyrrhotite
in the Fe ore recovery plant and feeding the gas therefrom, contg.
.apprx.10% SO₂, to H₂SO₄ plants; (3) combusting Cu conc. with
pure O, to give an off-gas contg. 75-80% SO₂,
which is cleaned and liquefied to give .apprx.100,000 tons liq.
SO₂/yr; (4) building of tall chimneys and adjusting smelter output
in relation to meteorol. conditions.
- IT 7446-09-5, biological studies
(air pollution by, by smelter at Copper Cliff, Ontario, control
of)
- RN 7446-09-5 HCA
- CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

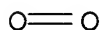
- CC 59-2 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 49, 54
- ST sulfur dioxide control copper smelter; magnetic sepn pyrrhotite
copper smelter; pyrrhotite roasting **sulfur dioxide
recovery**; chimney height sulfur dioxide dispersion
- IT 7446-09-5, biological studies
(air pollution by, by smelter at Copper Cliff, Ontario, control
of)
- L51 ANSWER 31 OF 40 HCA COPYRIGHT 2005 ACS on STN
94:194351 Method and apparatus for decomposing a gas mixture containing
mainly sulfur dioxide and a lower boiling component. Lang, Udo;
Kick, Helmut; Schmid, Wolfgang (Linde A.-G., Fed. Rep. Ger.). Ger.

Offen. DE 2930522 19810219, 16 pp. (German). CODEN:
GWXXBX. APPLICATION: DE 1979-2930522 19790727.

- AB Gas mixts., esp. those from cyclic thermochem. H manufg. plants, contg. mainly SO₂ as well as O or N and H₂O vapor are cooled in a multiple-stage process with condensation of SO₂ and H₂O, followed by scrubbing the gas from the last stage in a column to **recover** the remaining SO₂. The wash liquor from the scrubbed is stripped in another column at increased pressure and with recirculation of the bottom liquor to the scrubber. The sepn. is good, the condensed components are recycled, and energy is recovered by O expansion.
- IT 7446-09-5P, preparation
(sepn. of, from oxygen, in cyclic thermochem. process for hydrogen manuf.)
- RN 7446-09-5 HCA
- CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



- IT 7782-44-7P, preparation
(sepn. of, from sulfur dioxide, in cyclic thermochem. manuf. of hydrogen from water)
- RN 7782-44-7 HCA
- CN Oxygen (8CI, 9CI) (CA INDEX NAME)

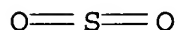


- IC C01B017-56
- CC 49-1 (Industrial Inorganic Chemicals)
- IT 7446-09-5P, preparation
(sepn. of, from oxygen, in cyclic thermochem. process for hydrogen manuf.)
- IT 7782-44-7P, preparation
(sepn. of, from sulfur dioxide, in cyclic thermochem. manuf. of hydrogen from water)

- L51 ANSWER 32 OF 40 HCA COPYRIGHT 2005 ACS on STN
- 93:116630 Oxygen recovery from gas mixtures. Norman, John H. (General Atomic Co., USA). U.S. US 4208396 19800617, 5 pp.
Cont.-in-part of U.S. 4,089,940. (English). CODEN: USXXAM.
APPLICATION: US 1977-865950 19771230.
- AB The O₂ in a mixt. with another gas is recovered by chem. oxidizing to a nongaseous product with a nongaseous oxidant without reacting the O₂. The process is esp. useful for removing SO₂ from an O₂-SO₂ mixt. such as occurs in the cyclic thermochem. manuf. of H₂ and O₂ from H₂O based on the reaction of H₂O, SO₂, and I₂. The O₂-SO₂

mixt. is injected into the bottom of a reactor contg. H₂O and I₂ at a rate sufficiently slow that all SO₂ is oxidized by the I₂ and the substantially **pure O₂** leaves at the top.

IT 7446-09-5, reactions
(oxidn. of, by iodine, for sepn. from oxygen)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

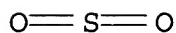


IC C01B013-00
INCL 423579000
CC 49-1 (Industrial Inorganic Chemicals)
IT 7553-56-2, reactions
(oxidn. by, of **sulfur dioxide** for oxygen
recovery)
IT 7446-09-5, reactions
(oxidn. of, by iodine, for sepn. from oxygen)

L51 ANSWER 33 OF 40 HCA COPYRIGHT 2005 ACS on STN
92:11596 Quantum yield of oxygen photoadsorption on zinc sulfide, copper-doped zinc sulfide, and silver-doped zinc sulfide. Gorodina, T. A.; Minakova, T. S. (USSR). Tezisy Dokl. Vses. Soveshch. "Tekhnol., Protsessy, Appar. Kach. Prom. Lyuminoforov", 67-9. Vses. Nauchno-Issled. Inst. Lyuminoforov Osobo Chist. Veshchestv: Stavropol, USSR. (Russian) 1977. CODEN: 41VJAN.

AB The spectral dependence of quantum yield of **O** photoadsorption on **pure** ZnS or ZnS:Cu and ZnS:Ag was studied. The quantum yield increases in the order ZnS < ZnS:Cu < ZnS:Ag. When thermally desorbed in H atm., H₂O and SO₂ form. The SO₂ concn. is high when desorbed rapidly and it is min. when desorbed at a very slow heating. The much lower quantum yield of **O** photoadsorption on **pure** ZnS as compared with that on ZnO is explained by the insignificant contribution to the photoadsorption of the discharge of **O** adsorbed in dark at room temp.

IT 7446-09-5P, preparation
(formation of, on rapid desorption of oxygen from zinc sulfide)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



CC 66-3 (Surface Chemistry and Colloids)
Section cross-reference(s): 73
IT Adsorption
(photo-, of **oxygen**, on **pure** and doped zinc

sulfide, quantum yield of)

IT 7446-09-5P, preparation
(formation of, on rapid desorption of oxygen from zinc sulfide)

L51 ANSWER 34 OF 40 HCA COPYRIGHT 2005 ACS on STN

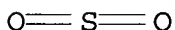
81:5106 Sulfur dioxide. Sasaki, Kazuo Jpn. Kokai
Tokkyo Koho JP 48099094 19731215 Showa, 3 pp. (Japanese).
CODEN: JKXXAF. APPLICATION: JP 1972-31444 19720329.

AB S or its compds. are burned in a gas contg. O,
H2O, and SO2 and cooled to condense H2O contg. SO2
, a portion of which is recycled. A gas contg. O
40, H2O 58.5, and SO2 1.5% was prepd. from O, H2O, and
satd. aq. SO2, and molten S was burned
in it. The gas was cooled to 25.degree. to obtain 100% SO2
when dried with H2SO4 and H2O contg. 9% SO2, which was
reused.

IT 7446-09-5P, preparation
(from sulfur, by combustion)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



INCL 15B111

CC 49-2 (Industrial Inorganic Chemicals)

ST sulfur dioxide manuf

IT 7446-09-5P, preparation
(from sulfur, by combustion)

L51 ANSWER 35 OF 40 HCA COPYRIGHT 2005 ACS on STN

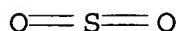
71:103721 Production of sulfur dioxide, oxygen, and hydrogen. Finfer,
Edward Z.; Maurer, Michael H. (Chemical Construction Corp.). Ger.
Offen. DE 1817177 19690814, 18 pp. (German). CODEN:
GWXXBX. PRIORITY: US 19671226.

AB Concd. SO2 in liq. or gas form for industrial use was obtained by
scrubbing stack gases having low SO2 content with NaOH and KOH soln.
(1-5 g./100 ml.), sepg. formed sulfites by cooling as ppt., and
subsequently decomp. the sulfites by dissolving in H2SO4-alkali
sulfate anolyte. By electrolyzing the anolyte in a conventional
Hg-electrolytic cell O2 and H2 were obtained as by-products, while
alkali hydroxide and H2SO4 were made for the process.

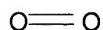
IT 7446-09-5P, preparation 7782-44-7P, preparation
(recovery of, from flue gases)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

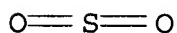


IC C01B; F23J
CC 49 (Industrial Inorganic Chemicals)
IT 1333-74-0P, preparation **7446-09-5P**, preparation
7664-93-9P, preparation **7782-44-7P**, preparation
(**recovery** of, from flue gases)

L51 ANSWER 36 OF 40 HCA COPYRIGHT 2005 ACS on STN
54:70922 Original Reference No. 54:13580i,13581a-b **Recovery**
of **sulfur dioxide** from waste gases. Tarbutton,
Grady; Driskell, John C.; Jones, Thomas M.; Smith, Carter M.
(Tennessee Valley Authority). US 2926999 **19600301**
(Unavailable). APPLICATION: US .

AB Gases contg. .ltoreq. 1% **SO2**, such as combustion products,
can be substantially freed from **SO2** with a min. vol. of
scrubbing liquid by adding 20 80 p.p.m. O3 (preferably about 40
p.p.m.) and scrubbing with an aq. soln. of H2SO4 or (NH4)2SO4 contg.
0.03-0.3% Mn. The gas must contain sufficient O2 to
convert **SO2** to SO3, and phenolic and Cu compds. must be
absent. The contact time should be 8-36 sec. when liquid is passed
down over the surfaces of packing in a tower, countercurrent to the
gas, preferably 12-36 sec. when H2SO4 is the product and 8-12 sec.
when NH3 is added to the tower. When H2SO4 is the product, the
concn. of the acid should not exceed 16-30% in the tower; both the
recovery of **SO2** and the efficiency of the O3 are
higher when more dil. acid is used as the absorption medium. Under
suitable conditions almost quant. **recovery** of **SO2**
is possible; **recoveries** may be somewhat less with
(NH4)2SO4 soln.

IT **7446-09-5, Sulfur dioxide**
(**recovery** of, from waste gases)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



CC 18 (Inorganic Industrial Chemicals)
IT Combustion

(of sulfur (molten) in SO2
manuf.)

IT Wastes

(sulfur dioxide recovery from
gaseous)

IT 7446-09-5, Sulfur dioxide

(recovery of, from waste gases)

L51 ANSWER 37 OF 40 HCA COPYRIGHT 2005 ACS on STN

52:12991 Original Reference No. 52:2353i,2354a Recovery of

sulfur dioxide from waste gases and ammonium

sulfate manufacture. Johnstone, Henry F.; West, Wm. E., Jr. (Texas
Gulf Sulphur Co.). US 2810627 19571022 (Unavailable).

APPLICATION: US .

AB SO2 is recovered from waste gases such as those

from the combustion of coal by scrubbing with aq. ammoniacal soln. .
to give an effluent contg. (NH4)2SO8 and NH4HSO3, (cf. C.A. 48,
11018b). The effluent is treated with air or pure

O to produce (NH4)2SO4 and SO2. The SO2 is stripped from
the soln. and the (NH4)2SO4 is crystd. from the residual soln.

IT 7446-09-5, Sulfur dioxide

(recovery of, from flue gases)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

CC 18 (Acids, Alkalies, Salts, and Other Heavy Chemicals)

IT Flue gases

(sulfur dioxide recovery from)

IT 7446-09-5, Sulfur dioxide

(recovery of, from flue gases)

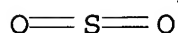
L51 ANSWER 38 OF 40 HCA COPYRIGHT 2005 ACS on STN

45:53946 Original Reference No. 45:9230e-g Canadian sulfur. Zabel,
Herman W. Chem. Inds., 63, 960 (Unavailable) 1948.

AB Canadian imports of S from the U.S. are being reduced by home
production of liquid SO2 from the roasting of pyritic Ni ore in
pure O2; 72% of the SO2 content of the roasted
gas, which contains 70% SO2, is condensed in a H2O-cooled condenser
at 120 lb./sq. in. The gases obtained by roasting the pyrites in
air contain only 6% of SO2 and for a 72% recovery of this gas a
pressure of 400 lb./sq. in. and a temp. of -70.degree. are needed.
After drying with 98% H2SO4, the gas is 99.9% pure and is used in
paper pulping. At the Noranda smelter, a thick bed of Fe pyrites on
a traveling hearth is ignited on the tip, and the reaction of the
high-temp. roasting fire is caused to travel downwards in a thin

band by controlling the air supply, so that half of the S distills as free S from the lower group of the bed and the remaining S is converted into SO₂ for making H₂SO₄ or for **recovery** as liquid **SO₂**.

IT 7446-09-5, Sulfur dioxide
(manuf. of, in Canada)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



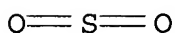
CC 18 (Acids, Alkalies, Salts, and Other Heavy Chemicals)
IT 7446-09-5, Sulfur dioxide 7664-93-9, Sulfuric acid
(manuf. of, in Canada)

L51 ANSWER 39 OF 40 HCA COPYRIGHT 2005 ACS on STN

31:53152 Original Reference No. 31:7371b-d **Sulfur dioxide recovery** at Trail. A general picture of the development and installation of the sulfur dioxide plants of the Consolidated Mining and Smelting Company of Canada, Limited, at Trail, B. C.. Lepsoe, R.; Kirkpatrick, W. S. Transactions - the Canadian Institute of Mining and Metallurgy and the Mining Society of Nova Scotia, 40, 399-404 From: Can. Mining Met. Bull. No. 304 (Unavailable) 1937. CODEN: TCIMAT. ISSN: 0371-5701.

AB From 50 to 60% of total S in gases is removed as 450 tons H₂SO₄ and 45 tons S per day. By flash roasting the Zn concentrate an 8% SO₂ gas, suitable for H₂SO₄ mfg., is obtained. SO₂ is absorbed from lower-grade gases with aq. NH₃ to give (NH₄)₂SO₃ or, with continued SO₂ passage, to NH₄HSO₃. Gas concn. is reduced to 0.1% SO₂. The resulting soln. contains 5-6 lb. SO₂ per gal. of soln. **SO₂** is **recovered** by H₂SO₄ treatment, and (NH₄)₂SO₄ crystd. for market, or by heating. SO₂ is used for manuf. of S or H₂SO₄. SO₂ + **pure O₂** is blown into a water-gas producer. The gases leaving the top are CO₂, S, CO and C oxysulfide. The latter + SO₂ react in a brick tower to form S.

IT 7446-09-5, Sulfur dioxide
(**recovery** of, at Trail, B. C.)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



CC 9 (Metallurgy and Metallography)
IT 7664-93-9, Sulfuric acid
(manuf. of, from **SO₂ recovered** in Zn roasting at Trail)

- IT 7440-66-6, Zinc
(metallurgy of, roasting, **SO2 recovery** at Trail in)
- IT **7446-09-5, Sulfur dioxide**
(**recovery** of, at Trail, B. C.)
- IT 7704-34-9, Sulfur
(**recovery** of, from **SO2** or **SO2-contg.** gases)

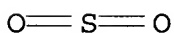
L51 ANSWER 40 OF 40 HCA COPYRIGHT 2005 ACS on STN
30:17759 Original Reference No. 30:2334c-d Burning sulfur to
produce sulfur dioxide. Bencowitz,
Isaac (Texas Gulf Sulphur Co.). US 2031403 **19360218**
(Unavailable). APPLICATION: US .

AB **Molten S and O are introduced**
, in independently regulable quantities, into a heated combustion chamber, simultaneously agitated to effect intimate admixt., and the mixt. is passed along a tortuous path in the heated combustion chamber to oxidize the S, and the mixt. of gases is subsequently passed through heated checkerwork. App. is described.

IT **7446-09-5, Sulfur dioxide**
(**manuf.** of)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



- (**recovery** of, from gases)
- CC 18 (Acids, Alkalies, Salts, and Other Heavy Chemicals)
- IT **7446-09-5, Sulfur dioxide**
(**manuf.** of)
- IT **7446-09-5, Sulfur dioxide**
(**recovery** of, from gases)

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L52 ANSWER 1 OF 24 HCA COPYRIGHT 2005 ACS on STN
139:190143 Determination of total sulphur by vacuum combustion extraction - quadrupole mass spectrometry (VCE - QMS). Sayi, Y. S.; Shankaran, P. S.; Yadav, C. S.; Chhapru, G. C.; Ramakumar, K. L.; Venugopal, V. (Fuel Chemistry Division, Bhabha Atomic Research Centre, Mumbai, 400 085, India). Proceedings of the National Academy of Sciences, India, Section A: Physical Sciences, 72(3), 241-248 (English) **2002**. CODEN: PAIAA3. ISSN: 0369-8203. Publisher: National Academy of Sciences, India.

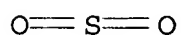
AB A vacuum combustion extn. cum quadrupole mass spectrometric (VCE-QMS) technique was developed for the detn. of total sulfur.

The method involves combustion of sample under vacuum in the presence of oxygen generating substance or **pure oxygen** to convert sulfur into sulfur dioxide, extn. of gases into a known vol., measurement of pressure and compn. by differential oil manometer and quadrupole mass spectrometer resp. The concn. is then evaluated from the pressure values. The method is applicable both at trace and major levels of sulfur. The precision of the method is better than 10% and 3% at trace levels and major levels resp.

IT 7704-34-9, Sulfur, analysis
(total sulfur detn. by vacuum combustion and quadrupole mass spectrometry)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5, Sulfur dioxide, analysis
(total sulfur detn. by vacuum combustion and quadrupole mass spectrometry)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

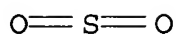


CC 79-4 (Inorganic Analytical Chemistry)
IT 7704-34-9, Sulfur, analysis
(total sulfur detn. by vacuum combustion and quadrupole mass spectrometry)
IT 7446-09-5, Sulfur dioxide, analysis
(total sulfur detn. by vacuum combustion and quadrupole mass spectrometry)

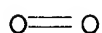
L52 ANSWER 2 OF 24 HCA COPYRIGHT 2005 ACS on STN
139:38918 Desulfurization with improved sorbent regeneration. Gislason, Jason J.; Brown, Ronald E.; Morton, Robert W.; Dodwell, Glenn W. (Conocophillips Company, USA). U.S. Pat. Appl. Publ. US 2003114296 A1 20030619, 11 pp. (English). CODEN: USXXCO. APPLICATION: US 2001-25343 20011219.

AB During regeneration of a sulfurized sorbent, the oxygen partial pressure in the regeneration zone is controlled to minimize sulfation of the sorbent.

IT 7446-09-5, Sulfur dioxide, formation (nonpreparative)
(desulfurization with improved zinc-based sorbent regeneration)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IT 7782-44-7, Oxygen, reactions
(desulfurization with improved zinc-based sorbent regeneration)
RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IT 7704-34-9, Sulfur, reactions
(desulfurization with improved zinc-based sorbent regeneration)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IC ICM B01J038-12
INCL 502038000; 423622000
CC 51-6 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67
ST desulfurization sorbent regeneration hydrodesulfurization; gasoline
zinc oxide sulfide desulfurization sorbent **regeneration**
SO₂ content; zinc sorbent promoter metal regeneration oxygen
oxidn hydrogen redn
IT 7446-09-5, Sulfur dioxide, formation (nonpreparative)
(desulfurization with improved zinc-based sorbent regeneration)
IT 1333-74-0, Hydrogen, reactions 7782-44-7, Oxygen,
reactions
(desulfurization with improved zinc-based sorbent regeneration)
IT 7704-34-9, Sulfur, reactions
(desulfurization with improved zinc-based sorbent regeneration)

L52 ANSWER 3 OF 24 HCA COPYRIGHT 2005 ACS on STN
138:291809 Biological treatment of NO_x and SO₂. Philip, Ligy;
Deshusses, Marc A. (Dept. of Civil Engineering, Indian Institute of
Technology, Madras, 600 036, India). Proceedings of the Air & Waste
Management Association's Annual Conference & Exhibition, 95th,
Baltimore, MD, United States, June 23-27, 2002, 3984-3995. Air &
Waste Management Association: Pittsburgh, Pa. ISBN: 0-923204-45-8
(English) 2002. CODEN: 69DMAK.

AB Complete treatment of flue gas SO₂ in a 2-stage process consisting
of a biotrickling filter followed by biol. post-treatment unit was
examd. The biotrickling filter removed 100% of influent SO₂ from
simulated flue gas at an empty bed residence time of 6 s at concns.

of 300-1000 ppmv. All absorbed SO₂ was recovered in the biotrickling filter liq. effluent as sulfites (a chem. reaction product of SO₂) and SO₄²⁻ (a product of biol. oxidn. of sulfites). The biotrickling filter liq. effluent was further processed biol. in a post-treatment unit consisting of a combined anaerobic and micro-aerophilic reactor fed glucose as a C source for SO₄²⁻ and sulfite redn. The post-treatment unit effectively treated trickling water to produce elemental S. S prodn. efficiency reached .apprx.80% of SO₂ treated. This biol. treatment system seems a promising alternative for flue gas desulfurization.

IT 7704-34-9, Sulfur, processes
(elemental; removing flue gas nitrogen oxides and sulfur dioxide in two-stage biotrickling filter and anaerobic/aerophilic bioreactor)

RN 7704-34-9 HCA

CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7782-44-7, Oxygen, processes
(removing flue gas nitrogen oxides and sulfur dioxide in two-stage biotrickling filter and anaerobic/aerophilic bioreactor)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7446-09-5, Sulfur dioxide, processes
(removing flue gas nitrogen oxides and sulfur dioxide in two-stage biotrickling filter and anaerobic/aerophilic bioreactor)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

CC 59-4 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 10, 60, 67

IT 7704-34-9, Sulfur, processes
(elemental; removing flue gas nitrogen oxides and sulfur dioxide in two-stage biotrickling filter and anaerobic/aerophilic bioreactor)

IT 7782-44-7, Oxygen, processes
(removing flue gas nitrogen oxides and sulfur dioxide in

two-stage biotrickling filter and anaerobic/aerophilic bioreactor)

IT 7446-09-5, Sulfur dioxide, processes 10102-43-9, Nitric oxide, processes 11104-93-1, Nitrogen oxide, processes (removing flue gas nitrogen oxides and sulfur dioxide in two-stage biotrickling filter and anaerobic/aerophilic bioreactor)

L52 ANSWER 4 OF 24 HCA COPYRIGHT 2005 ACS on STN

137:142825 Coupled electromagnetic and acoustic pulse-based stimulation of petroleum reservoirs with electrohydraulic and electromagnetic discharge. Thomas, Sally A.; Gilbert, William W.; Huffman, Alan Royce (Conoco Inc., USA). U.S. US 6427774 B1 20020806, 23 pp., Cont.-in-part of U.S. 6,227,293. (English). CODEN: USXXAM. APPLICATION: US 2001-755228 20010105. PRIORITY: US 2000-500669 20000209.

AB Intense and short-lived electromagnetic pulses are coupled with acoustic pulses into a petroleum reservoir, which mobilized petroleum and increases flow of recovered crude oil. The acoustic pulses are derived from the plasma vaporization of water. Among other configurations, electrohydraulic and electromagnetic generators are placed in a movable emitter that can be passed between productive zones and generate acoustic vibrations and electromagnetically induced high-frequency vibrations over a desired vol. of the reservoir. The method can be used with other enhanced oil recovery methods, such as waterflooding, CO2-flooding, surfactant flooding, etc., for enhanced recovery of heavy petroleum. In addn., the methods can also be used for recovery or sepn. of other petroleum components or other underground material, such as natural gas, methane, natural gas condensates, casinghead naphtha, N2, Ar, He, O2, H2S, CO2, SO2, B, V, Ni, S, and asphaltenes.

IT 7446-09-5, Sulfur dioxide, processes
7704-34-9, Sulfur, processes 7782-44-7, Oxygen, processes
(recovery of; coupled electromagnetic and acoustic pulse-based stimulation of petroleum reservoirs)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

RN 7704-34-9 HCA

CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IC ICM E21B043-25
ICS E21B028-00

INCL 166248000

CC 51-1 (Fossil Fuels, Derivatives, and Related Products)

IT 124-38-9, Carbon dioxide, processes 7440-02-0, Nickel, processes
7440-37-1, Argon, processes 7440-42-8, Boron, processes
7440-59-7, Helium, processes 7440-62-2, Vanadium, processes
7446-09-5, Sulfur dioxide, processes
7704-34-9, Sulfur, processes 7727-37-9, Nitrogen,
processes **7782-44-7, Oxygen, processes** 7783-06-4,
Hydrogen sulfide, processes
(**recovery** of; coupled electromagnetic and acoustic
pulse-based stimulation of petroleum reservoirs)

L52 ANSWER 5 OF 24 HCA COPYRIGHT 2005 ACS on STN

133:111868 Dust formation in carbon-rich Wolf-Rayet stars. Part 1.
Chemistry of small carbon clusters and silicon species. Cherchneff,
I.; Le Teuff, Y. H.; Williams, P. M.; Tielens, A. G. G. M.
(Department of Physics, UMIST, Manchester, M60 1QD, UK). Astronomy
and Astrophysics, 357(2), 572-580 (English) 2000. CODEN:
AAEJAF. ISSN: 0004-6361. Publisher: Springer-Verlag.

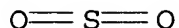
AB The formation of small C chains and mol. precursors to SiC grains
was investigated in the hot, hostile environment of C-rich
Wolf-Rayet (WC) winds. We consider only WC stars which produce dust
on a continuous basis and develop for the 1st time non-equil., chem.
kinetic routes to nucleating dust precursors in the outflow. These
can be used to calc. quant. the yield of such dust precursors for
various outflow scenarios. Because WC stars have lost all their H
in the WN phase, the chem. processes used in the model involve a
pure He, C, O, Si, and S chem. which resembles
that encountered in graphite or metal vaporization expts. in the
lab. We derive abundances for small linear C clusters up to C6 and
Si-bearing species for various wind parameters and conclude that
high-d. regions in the form of clumps or disks are of paramount
importance to the formation of dust in WC stars.

IT **7446-09-5, Sulfur dioxide, occurrence** **7704-34-9,**
Sulfur, occurrence

(dust formation in C-rich Wolf-Rayet stars including chem. of
small C clusters and Si species)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



RN 7704-34-9 HCA
 CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

CC 73-9 (Optical, Electron, and Mass Spectroscopy and Other Related Properties)

IT 409-21-2, Silicon carbide (SiC), occurrence 463-58-1, Carbon oxide sulfide (COS) 630-08-0, Carbon monoxide, occurrence 2944-05-0, Carbon monosulfide . 7440-21-3, Silicon, occurrence 7440-44-0D, Carbon, clusters, occurrence 7446-09-5, Sulfur dioxide, occurrence 7704-34-9, Sulfur, occurrence 7782-44-7, Oxygen, occurrence 10097-28-6, Oxosilylene 12070-15-4, 1,2-Ethynediyl 12071-27-1, Silicon carbide (SiC2) 12075-35-3, 1,2-Propadiene-1,3-diylidene 12144-04-6, Carbon monoxide(1+), occurrence 12169-37-8, Carbon oxide sulfide (COS), ion(1+) 12181-61-2, Carbon dioxide(1+), occurrence 12185-07-8, Oxygen, ion (O21+) 12351-95-0, Carbon sulfide (CS), ion(1+) 12359-18-1, Silyliumyl, oxo- 12359-46-5, Silyliumyl, thioxo- 12439-77-9, Sulfur dioxide(1+) 12504-41-5, Silicon sulfide (SiS) 12595-78-7, Ethynyl, ion(1-) 12595-79-8, 2-Ethynylium-1-yl 12597-02-3, Sulfur, ion (S21+), occurrence 13827-32-2, Sulfur monoxide 14067-05-1, Carbon1+, occurrence 14067-07-3, Silicon1+, occurrence 14337-00-9, Carbon1-, occurrence 14337-01-0, Oxygen1-, occurrence 14337-03-2, Sulfur1-, occurrence 14581-93-2, Oxygen1+, occurrence 14701-12-3, Sulfur1+, occurrence 16092-61-8, Carbon2+, occurrence 17778-80-2, occurrence 23550-45-0, Sulfur, mol (S2), occurrence 78393-58-5, Silicon(1+), methanetetrayl 109292-47-9, 1,2-Propadien-1-yl-3-ylidene, ion(1-) 118090-85-0, 1,2-Propadien-1-ylum-1-yl-3-ylidene 146021-58-1, Silicon(1+), dimethanetetrayl 175780-11-7, Carbon, mol (C4), occurrence 767269-11-4, Sulfur oxide, ion (SO+)
 (dust formation in C-rich Wolf-Rayet stars including chem. of small C clusters and Si species)

L52 ANSWER 6 OF 24 HCA COPYRIGHT 2005 ACS on STN

132:55238 Reaction of SO2 with ZnO(0001)-O and ZnO powders.

Photoemission and XANES studies on the formation of SO3 and SO4.

Rodriguez, J. A. J. A.; Jirsak, T.; Chaturvedi, S.; Kuhn, M.

(Department of Chemistry, Brookhaven National Laboratory, Upton, NY, USA). Surface Science, 442(3), 400-412 (English) 1999.

CODEN: SUSCAS. ISSN: 0039-6028. Publisher: Elsevier Science B.V..

AB Synchrotron-based high-resoln. photoemission and x-ray absorption near-edge spectroscopy (XANES) were used to study the interaction of

SO₂ with ZnO(0001)-O and polycryst. films and bulk powders of ZnO. The adsorption of SO₂ on the (0001) oxygen-terminated face of ZnO at 110 K produced SO₃ species which were stable up to temps. well above 400 K. On polycryst. ZnO, the Zn.tautm.SO₂ interactions were very weak, there was no decompn. of the admol., and evidence for bonding of Zn to SO₂ was found only at low temps. (.apprxeq.100 K) when the adsorbate had a limited mobility on the surface. At 300 K and moderate pressures, SO₂ only reacted with the oxygen centers of ZnO forming mainly SO₃ groups. Part of the formed SO₃ decompd. at temps. between 400 and 600 K with evolution of SO₂ into the gas phase (ZnSO₃,solid .fwdarw. SO₂,gas + ZnOsolid). At 600 K, a significant amt. of SO₃ was still present on the ZnO systems. Reaction with O₂ led to an SO₃ .fwdarw. SO₄ transformation on ZnO(0001)-O and powders of ZnO previously exposed to SO₂. SO₄ was directly formed during the adsorption of SO₂ on polycryst. surfaces of ZnO that were rich in oxygen atoms which had a low coordination no. (<3) and a relatively high mobility. On ZnO(0001)-O and polycryst. ZnO, there was no decompn. of SO₂. Promotion with K and Cs facilitated the cleavage of S-O bonds. After dosing SO₂ to (.sqroot.3 .times. .sqroot.3)-K/ZnO(0001)-O and (.sqroot.3 .times. .sqroot.3)-Cs/ZnO(0001)-O at 300 K, several sulfur species (S, SO₃, SO₄) coexisted on the alkali-metal-promoted surfaces whereas only SO₃ was formed on the **pure** ZnO(0001)-O system.

IT 7704-34-9, Sulfur, formation (nonpreparative)
 (formation in reaction of SO₂ with ZnO(0001)-O and ZnO powders)
 RN 7704-34-9 HCA
 CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5, Sulfur dioxide, reactions
 (formation of SO₃ and SO₄ in reaction of SO₂ with ZnO(0001)-O and ZnO powders)
 RN 7446-09-5 HCA
 CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

CC 66-3 (Surface Chemistry and Colloids)
 IT 7446-11-9, Sulfurtrioxide, formation (nonpreparative)
 7704-34-9, Sulfur, formation (nonpreparative) 14808-79-8,
 Sulfate, formation (nonpreparative)
 (formation in reaction of SO₂ with ZnO(0001)-O and ZnO powders)
 IT 1314-13-2, Zinc oxide, reactions 7446-09-5, Sulfur
 dioxide, reactions 17778-80-2D, Oxygen, atomic, zinc
 oxide-terminating, reactions

(formation of SO₃ and SO₄ in reaction of SO₂ with ZnO(0001)-O and ZnO powders)

L52 ANSWER 7 OF 24 HCA COPYRIGHT 2005 ACS on STN

131:276032 Recovery of H₂S in coke oven gas as elemental sulfur and ammonium sulfate by catalytic oxidation. Park, Dae Won; Chun, Sung Woo; Kim, Hyo Sun; Woo, Hee Chul; Chung, Jong Shik (Department of Chemical Engineering, Pusan National University, Pusan, 609-735, S. Korea). Studies in Surface Science and Catalysis, 121 (Science and Technology in Catalysis 1998), 457-460 (English) 1999.

CODEN: SSCTDM. ISSN: 0167-2991. Publisher: Elsevier Science B.V..

AB Selective catalytic oxidn. of coke oven gas H₂S in the presence of excess water and NH₃ over V₂O₅/SiO₂ catalyst was studied. H₂S was successfully converted to the mixt. of elemental S and ammonium thiosulfate without considerable SO₂ emission. Plausible reaction steps are proposed to describe kinetic exptl. results.

IT 7446-09-5, Sulfur dioxide, processes

(conversion/recovery of hydrogen sulfide from coke oven gas as elemental sulfur and ammonium thiosulfate by selective catalytic oxidn. over silica-supported vanadia catalyst in presence of excess water, ammonia, and oxygen)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IT 7782-44-7, Oxygen, reactions

(conversion/recovery of hydrogen sulfide from coke oven gas as elemental sulfur and ammonium thiosulfate by selective catalytic oxidn. over silica-supported vanadia catalyst in presence of excess water, ammonia, and oxygen)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7704-34-9P, Sulfur, processes

(elemental; conversion/recovery of hydrogen sulfide from coke oven gas as elemental sulfur and ammonium thiosulfate by selective catalytic oxidn. over silica-supported vanadia catalyst in presence of excess water, ammonia, and oxygen)

RN 7704-34-9 HCA

CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

- CC 59-4 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 51, 67
- IT 7446-09-5, Sulfur dioxide, processes
(conversion/recovery of hydrogen sulfide from coke oven gas as elemental sulfur and ammonium thiosulfate by selective catalytic oxidn. over silica-supported vanadia catalyst in presence of excess water, ammonia, and oxygen)
- IT 7664-41-7, Ammonia, reactions 7732-18-5, Water, reactions
7782-44-7, Oxygen, reactions
(conversion/recovery of hydrogen sulfide from coke oven gas as elemental sulfur and ammonium thiosulfate by selective catalytic oxidn. over silica-supported vanadia catalyst in presence of excess water, ammonia, and oxygen)
- IT 7704-34-9P, Sulfur, processes
(elemental; conversion/recovery of hydrogen sulfide from coke oven gas as elemental sulfur and ammonium thiosulfate by selective catalytic oxidn. over silica-supported vanadia catalyst in presence of excess water, ammonia, and oxygen)
- L52 ANSWER 8 OF 24 HCA COPYRIGHT 2005 ACS on STN
131:259736 O2/recycled flue gas combustion-applied powderized coal fired power plant for recovery. Yamada, Toshihiko; Kiga, Takashi; Fujita, Naofumi; Inoue, Toshio (Combustion Engineering Department, Power Plant Division, Energy Plants, Japan). IHI Engineering Review, 32(3), 98-103 (English) 1999. CODEN: IHERA6. ISSN: 0018-9820. Publisher: Ishikawajima-Harima Heavy Industries Co., Ltd..
- AB Amid growing concerns internationally about reducing CO2 emissions, fossil fuel-fired power plants are now being targeted as a source of CO2 emissions that results in environmental problems. To improve this situation, it is necessary to advance the study of O2/RFG combustion-applied pulverized coal fired power plant for CO2 recovery. This power plant system is characterized by effective O2/RFG combustion, gas recirculation, and pressure control in the furnace through use of CO2 compressors and oxygen concn. controls at several points. Possibility of practical application and safety were confirmed after plant simulation and examn.
- IT 7782-44-7, Oxygen, analysis
(O2/recycled flue gas combustion-applied powderized coal fired power plant for CO2 recovery)
- RN 7782-44-7 HCA
- CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

- IT 7446-09-5, Sulfur dioxide, analysis

7704-34-9, Sulfur, analysis

(O2/recycled flue gas combustion-applied powderized
coal fired power plant for CO2 recovery)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

RN 7704-34-9 HCA

CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

CC 51-18 (Fossil Fuels, Derivatives, and Related Products)

Section cross-reference(s): 48, 59

IT 7782-44-7, Oxygen, analysis

(O2/recycled flue gas combustion-applied powderized coal fired
power plant for CO2 recovery)

IT 74-82-8, Methane, analysis 630-08-0, Carbon monoxide, analysis

1333-74-0, Hydrogen, analysis 7440-44-0, Carbon, analysis

7446-09-5, Sulfur dioxide, analysis

7704-34-9, Sulfur, analysis 7727-37-9, Nitrogen, analysis

10102-43-9, Nitrogen oxide (NO), analysis 11104-93-1, Nitrogen

oxide, analysis 12385-13-6, Atomic hydrogen, analysis

17778-80-2, Atomic oxygen, analysis

(O2/recycled flue gas combustion-applied powderized
coal fired power plant for CO2 recovery)

L52 ANSWER 9 OF 24 HCA COPYRIGHT 2005 ACS on STN

130:239493 Simulation of once-through sulfur Claus process.

El-Bishtawi, Ribhi; Haimour, No'man (Department of Chemical
Engineering, University of Jordan, Amman, Jordan). Dirasat: Natural
and Engineering Sciences, 24(1), 7-18 (English) 1997.

CODEN: DNESFZ. ISSN: 1026-3756. Publisher: University of Jordan,
Deanship of Academic Research.

AB A computer program was developed to simulate the once-through Claus
process. The effects of changing N2/O2 ratio on sulfur recovery,
adiabatic flame temp., heat recovery, molar flowrates and the
capacity of the unit were detd. By using **pure**
oxygen instead of air, the percentage sulfur recovery from
the first condenser is increased from 75.25% to 82.63%, the
adiabatic flame temp. is increased from 1500.degree. to
2725.degree., the amt. of heat recovered from the waste heat boiler
is increased by 5%, the total molar flowrate is decreased by 56% in
the furnace, 62% in the waste heat boiler, 65% in the condensers and
65% in the catalytic converters. The capacity of the unit can be

increased by 163%. A modified unit is suggested, which consists of a furnace; a waste heat boiler, a sulfur condenser and a water condenser with recycling of effluent gases. A purge stream is required to keep the level of inerts concn. to an acceptable level.

IT 7704-34-9P, Sulfur, preparation
(simulation of once-through sulfur Claus process)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5, Sulfur dioxide, reactions
(simulation of once-through sulfur Claus process)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 59

IT 7704-34-9P, Sulfur, preparation
(simulation of once-through sulfur Claus process)

IT 7446-09-5, Sulfur dioxide, reactions 7782-44-7, Oxygen,
reactions 7783-06-4, Hydrogen sulfide, reactions
(simulation of once-through sulfur Claus process)

L52 ANSWER 10 OF 24 HCA COPYRIGHT 2005 ACS on STN

130:170530 Manufacture of valuable products from low-rank coal. Koya, Toshiyuki; Shiraishi, Takao; Murase, Hiroshi; Shimizu, Tadaaki; Matsukata, Masahiko (Ebara Corp., Japan). Jpn. Kokai Tokkyo Koho JP 11035958 A2 19990209 Heisei, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1997-194485 19970718.

AB The title method comprises (1) deashing-desulfurizing a low-rank coal to obtain a low-pollution fuel by a deashing-desulfurizing app., (2) moisture adjusting the high-ash, high-S and high-water-contg. residual coal from the stage (1) by a water-adjusting app., (3) combusting-slugging the moisture-adjusted residual coal to obtain a slag by combusting with pure O, (4) power-generating by steam with waste-heat recovery, and (5) manufg. elemental S or H2SO4 by supplying SO2-contg. exhaust gas from the stage (3) after recovery of fly ashes.

IT 7704-34-9P, Sulfur, preparation
(elemental; manuf. of valuable products from low-rank coal)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5, Sulfur dioxide, reactions
(exhaust gases contg.; in manuf. of valuable products from
low-rank coal)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IC ICM C10L005-00
ICS C01B017-04; C01B017-69; C10K001-10
CC 51-17 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 49, 52
IT 7704-34-9P, Sulfur, preparation
(elemental; manuf. of valuable products from low-rank coal)
IT 7446-09-5, Sulfur dioxide, reactions
(exhaust gases contg.; in manuf. of valuable products from
low-rank coal)

L52 ANSWER 11 OF 24 HCA COPYRIGHT 2005 ACS on STN
129:346660 KEMA's hot gas clean-up process. Meijer, R.; Janssen, F. J.
J. G.; Farina, G. L.; Hellendoorn, J. W. H. (Business Unit KEMA
Fossil Power Plants, KEMA Nederland B.V., Arnhem, 6800, Neth.).
High Temperature Gas Cleaning, [Papers presented at the
International Symposium and Exhibition on Gas Cleaning at High
Temperatures], 3rd, Karlsruhe, Sept. 18-20, 1996, 638-647.
Editor(s): Schmidt, Eberhard. Institut fuer Mechanische
Verfahrenstechnik und Mechanik der Universitaet Karlsruhe (TH):
Karlsruhe, Germany. (English) 1996. CODEN: 66SOAC.

AB KEMA developed and patented a sorbent and hot gas cleanup process
(HGCK) to clean flue gas from coal, oil, and biomass gasification
processes. The main feature of this process is its continuous dry
desulfurization system, applying a supported sorbent developed and
patented by KEMA. The desulfurization sorbent is transported
between 2 bubbling fluidized bed reactor systems, one of which acts
as absorber and the other as regenerator. The primary regeneration
product is elemental S. Exptl. work showed the sorbent can also
remove HCN and NH3 simultaneously with H2S and COS. Process
integration calcns. for application of the HGCK process in a 550 MWe
indicated that with the HGCK process, a significant improvement in
plant efficiency and a strong redn. of investment costs vs.
conventional cold gas cleaning is achievable. Lower annual
operating costs lead to a significant redn. of the cost of
electricity produced. In 1995, KEMA and Foster Wheeler agreed to
develop a com. hot gas clean-up process based on fluidized bed

technol. and direct S prodn. This program consists of a cold model test, followed by demonstration of the HGCK process on an IGCC plant slipstream.

IT 7704-34-9P, Sulfur, processes
 (regenerable sorbents for hot flue gas desulfurization clean-up process)
 RN 7704-34-9 HCA
 CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5, Sulfur dioxide, uses
 7782-44-7, Oxygen, uses
 (sorbent **regeneration** using; regenerable sorbents for hot flue gas desulfurization clean-up process)
 RN 7446-09-5 HCA
 CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

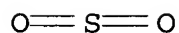
RN 7782-44-7 HCA
 CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

CC 59-4 (Air Pollution and Industrial Hygiene)
 Section cross-reference(s): 51
 IT 7704-34-9P, Sulfur, processes
 (regenerable sorbents for hot flue gas desulfurization clean-up process)
 IT 7446-09-5, Sulfur dioxide, uses
 7782-44-7, Oxygen, uses
 (sorbent **regeneration** using; regenerable sorbents for hot flue gas desulfurization clean-up process)

L52 ANSWER 12 OF 24 HCA COPYRIGHT 2005 ACS on STN
 129:346654 Sulfidation-regeneration kinetics of zinc titanate sorbents. Mojtahedi, Wahab; Konttinen, Jukka; Gangwal, Santosh (EnviroPower Inc., Tampere, 33701, Finland). High Temperature Gas Cleaning, [Papers presented at the International Symposium and Exhibition on Gas Cleaning at High Temperatures], 3rd, Karlsruhe, Sept. 18-20, 1996, 557-568. Editor(s): Schmidt, Eberhard. Institut fuer Mechanische Verfahrenstechnik und Mechanik der Universitaet Karlsruhe (TH): Karlsruhe, Germany. (English) 1996.
 CODEN: 66SOAC.

- AB Advanced integrated gasification combined-cycle power systems incorporate pressurized coal gasification and hot-gas cleanup. A high-temp., high-pressure (HTHP) S removal sub-system is a key component of the hot-gas clean-up train. H₂S is the main S compd. in coal gasifier gas. Regenerable Zn-based mixed-metal oxide sorbents, which can be regenerated for multi-cycle operation using air, are typically used to remove H₂S to <50 ppmv. Zinc titanate sorbents are currently leading sorbent candidates for fluidized-bed, reactor-based desulfurization sub-systems; data on sulfidation and regeneration kinetics of these sorbents are needed for reliable system design. Sulfidation kinetics of a no. of zinc titanate sorbents were evaluated using a thermogravimetric analyzer (TGA) and a high-pressure micro fixed-bed reactor (MFBR) at 0.1-2.0 MPa and 400-600.degree. in the presence of simulated U-Gas. Regeneration kinetics of a selected sorbent was evaluated using TGA at 0.1 MPa and 400-775.degree. as a function of O₂ concn. (0.2-2.92 vol. percent) and SO₂ concn. (0.18-2.58 vol. percent). All data were fitted using Class II, second-order rate equations. Sulfidation rate consts. from the MFBR were 4-6 times smaller than those from TGA; potential reasons for this disagreement are discussed. TGA data indicated the sulfidation reaction has an activation energy of .apprx.77 kJ/mol, whereas the regeneration reaction has an activation energy of .apprx.200 kJ/mol. The presence of SO₂ in **regeneration** gas did not have a retarding effect on overall regeneration rates at temps. 575-725.degree.. Data further indicated that ZnSO₄ formation during regeneration can be minimized by keeping the sorbent sulfided to at least a 10% conversion level. Application and implications of results obtained for design of a continuous large-scale fluidized-bed reactor system are discussed.
- IT 7782-44-7, Oxygen, processes
(regenerating zinc titanate sorbent with; sulfidation-regeneration kinetics of zinc titanate sorbents for hot coal-fired power generation and coal gasification flue gases)
- RN 7782-44-7 HCA
- CN Oxygen (8CI, 9CI) (CA INDEX NAME)
- O=O
- IT 7446-09-5, Sulfur dioxide, processes
7704-34-9, Sulfur, processes
(sulfidation-**regeneration** kinetics of zinc titanate sorbents for hot coal-fired power generation and coal gasification flue gases)
- RN 7446-09-5 HCA
- CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

CC 59-4 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 51, 67

IT 7782-44-7, Oxygen, processes
(regenerating zinc titanate sorbent with; sulfidation-
regeneration kinetics of zinc titanate sorbents for hot
coal-fired power generation and coal gasification flue gases)

IT 7446-09-5, Sulfur dioxide, processes
7704-34-9, Sulfur, processes 7783-06-4, Hydrogen sulfide,
processes
(sulfidation-**regeneration** kinetics of zinc titanate
sorbents for hot coal-fired power generation and coal
gasification flue gases)

L52 ANSWER 13 OF 24 HCA COPYRIGHT 2005 ACS on STN
128:184004 Refineries have to do a retrofit. Oxygen increases the
desulfurization capacity of Claus units. Gross, Gerhard (Germany).
Chemie-Anlagen + Verfahren, 31(2), 56-57 (German) 1998.
CODEN: CHAVBZ. ISSN: 0009-2800. Publisher: Konradin Verlag Robert
Kohlhammer.

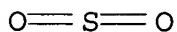
AB Liq. fuels were desulfurized in the refineries with so-called
hydrotreaters, and thereby a gaseous mixt. with a content of up to
90% H₂S was formed. This co-called "Claus-gas" was combusted with
air to S, which was used for industrial processes such as the
synthesis of H₂SO₄. An improved Claus combustion chamber is
presented, working with **pure O₂** in the secondary
combustion stage. The S-throughput was increased with this technol.
to 55%. Investment costs for the implementation of this new
technol. into the Claus plant are given.

IT 7704-34-9P, Sulfur, preparation
(sulfur manuf. by postcombustion of Claus gas with oxygen in
desulfurization of liq. fuels in petroleum refineries with
hydrotreaters)

RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5, Sulfur dioxide, reactions
(sulfur manuf. by postcombustion of Claus gas with oxygen in
desulfurization of liq. fuels in petroleum refineries with
hydrotreaters)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



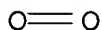
CC 59-4 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 49, 51
IT 7704-34-9P, Sulfur, preparation
(sulfur manuf. by postcombustion of Claus gas with oxygen in
desulfurization of liq. fuels in petroleum refineries with
hydrotreaters)
IT 7446-09-5, Sulfur dioxide, reactions
(sulfur manuf. by postcombustion of Claus gas with oxygen in
desulfurization of liq. fuels in petroleum refineries with
hydrotreaters)

L52 ANSWER 14 OF 24 HCA COPYRIGHT 2005 ACS on STN

124:149991 Sulfur recovery from sulfur-containing streams. Cieutat,
Denis; Schmidt, Emmanuel (Air Liquide, Fr.; Air Liquide America
Corp.). Fr. Demande FR 2718726 A1 19951020, 24 pp.
(French). CODEN: FRXXBL. APPLICATION: FR 1995-4539 19950414.

AB The process comprises **recovering** a a SO₂-contg.
gas from a sulfurous waste gas-treating app., introducing a
H₂S-contg. gas into a Claus unit, reacting at least part of the
SO₂-contg. gas in the Claus unit, and a recovering a S-based product
from the Claus unit. The sulfurous waste gas may be gas from a
H₂SO₄ regenerating unit. This process is esp. suitable for use in
refineries.

IT 7782-44-7, Oxygen, uses
(sulfur recovery from sulfur-contg. streams in refineries)
RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IT 7446-09-5, Sulfur dioxide, processes
(sulfur **recovery** from sulfur-contg. streams in
refineries)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

$$\text{O}=\text{S}=\text{O}$$

IT 7704-34-9P, Sulfur, preparation
 (sulfur recovery from sulfur-contg. streams in refineries)
 RN 7704-34-9 HCA
 CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IC ICM C01B017-04
 CC 49-1 (Industrial Inorganic Chemicals)
 Section cross-reference(s): 51
 IT 7782-44-7, Oxygen, uses
 (sulfur recovery from sulfur-contg. streams in refineries)
 IT 7446-09-5, Sulfur dioxide, processes
 7783-06-4, Hydrogen sulfide, processes
 (sulfur **recovery** from sulfur-contg. streams in
 refineries)
 IT 7664-93-9P, Sulfuric acid, preparation 7704-34-9P, Sulfur,
 preparation
 (sulfur recovery from sulfur-contg. streams in refineries)

L52 ANSWER 15 OF 24 HCA COPYRIGHT 2005 ACS on STN

121:38660 Desulfurization of hydrogen sulfide-containing gases in a
 Claus plant, and post-combustion and scrubbing of the waste gases.
 Heisel, Michael; Marold, Freimut (Linde AG, Germany). Ger. Offen.
 DE 4239811 A1 19940601, 12 pp. (German). CODEN: GWXXBX.
 APPLICATION: DE 1992-4239811 19921126.

AB In this process, in which the SO₂ collected in the scrubber is
 recycled to the Claus plant, 60-90, preferably 67-85, esp. 67-80% of
 the S in the feed gas is directly removed, and 10-33, preferably
 10-25, esp. 15-20% of the S is **recycled SO₂**.
 This process has high S-recovery rates, and substantially lowers
 other emissions. CO, H₂, S(g), H₂S, CS₂, COS, NH₃, and HCN in the
 offgas from the Claus plant are used as fuel gas.

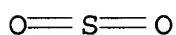
IT 7782-44-7P
 (combustion, of offgas from Claus plant, for high yield by
 scrubbing and **recycling of sulfur
 dioxide**)
 RN 7782-44-7 HCA
 CN Oxygen (8CI, 9CI) (CA INDEX NAME)

$$\text{O}=\text{O}$$

IT 7704-34-9
(hydrocarbons, Claus plant waste gases contg. hydrogen sulfide
and, combustion and scrubbing of, for **sulfur**
dioxide recycle and high sulfur yield)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5, **Sulfur dioxide**, uses
(**recycling** of, from post-combustion and scrubbing of
waste gas from Claus plant, for high sulfur yield)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IT 7704-34-9, Sulfur, reactions
(vapors, Claus plant waste gases contg. hydrogen sulfide and,
combustion and scrubbing of, for **sulfur dioxide**
recycle and high sulfur yield)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IC ICM C01B017-04
ICS C01B017-60; B01D053-36; F23G007-06
CC 49-1 (Industrial Inorganic Chemicals)
ST sulfur dioxide Claus waste gas combustion; scrubbing
recycling sulfur dioxide
IT Hydrocarbons, reactions
(Claus plant waste gases contg. hydrogen sulfide and, combustion
and scrubbing of, for **sulfur dioxide**
recycle and high sulfur yield)
IT Combustion
(of offgas from Claus plant, for high yield by scrubbing and
recycling of sulfur dioxide)
IT 74-90-8, Hydrogen cyanide, reactions 75-15-0, Carbon disulfide,
reactions 463-58-1, Carbonyl sulfide 630-08-0, Carbon monoxide,
reactions 7664-41-7, Ammonia, reactions
(Claus plant waste gases contg. hydrogen sulfide and, combustion
and scrubbing of, for **sulfur dioxide**
recycle and high sulfur yield)
IT 7782-44-7P

(combustion, of offgas from Claus plant, for high yield by scrubbing and **recycling of sulfur dioxide**)

IT 7704-34-9

(hydrocarbons, Claus plant waste gases contg. hydrogen sulfide and, combustion and scrubbing of, for **sulfur dioxide recycle** and high sulfur yield)

IT 7446-09-5, **Sulfur dioxide**, uses

(**recycling** of, from post-combustion and scrubbing of waste gas from Claus plant, for high sulfur yield)

IT 7783-06-4, Hydrogen sulfide, uses

(removal of, from waste gas, Claus process with post-combustion and scrubbing for, for **sulfur dioxide recycle**)

IT 7704-34-9, Sulfur, reactions

(vapors, Claus plant waste gases contg. hydrogen sulfide and, combustion and scrubbing of, for **sulfur dioxide recycle** and high sulfur yield)

L52 ANSWER 16 OF 24 HCA COPYRIGHT 2005 ACS on STN

120:81342 High temperature regenerable hydrogen sulfide removal agents for desulfurization in coal gasification. Copeland, Robert J. (TDA Research, Inc., USA). U.S. US 5271907 A 19931221, 21 pp. (English). CODEN: USXXAM. APPLICATION: US 1992-844829 19920303.

AB A system for high temp. desulfurization of coal-derived gases uses regenerable sorbents. One sorbent is stannic oxide (tin oxide, SnO_2), the other sorbent is a metal oxide or mixed metal oxide such as zinc ferrite (ZnFe_2O_4). Certain otherwise undesirable byproducts, including hydrogen sulfide (H_2S) and **sulfur dioxide** (SO_2) are **reused** by the system, and elemental sulfur is produced in the regeneration reaction. A system for refabricating the sorbent pellets is also described.

IT 7782-44-7, Oxygen, uses

(for sorbent regeneration in desulfurization in coal gasification)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O==O

IT 7704-34-9P, Sulfur, preparation

(formation of, in coal gasification with desulfurization using regenerable sorbents)

RN 7704-34-9 HCA

CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5, Sulfur dioxide, miscellaneous
(removal of, in coal gasification with regenerable sorbents)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

 $O=S=O$

IC ICM B01D053-02
INCL 422178000
CC 51-20 (Fossil Fuels, Derivatives, and Related Products)
IT 7782-44-7, Oxygen, uses
(for sorbent regeneration in desulfurization in coal
gasification)
IT 7704-34-9P, Sulfur, preparation
(formation of, in coal gasification with desulfurization using
regenerable sorbents)
IT 7446-09-5, Sulfur dioxide, miscellaneous 7783-06-4,
Hydrogen sulfide, miscellaneous
(removal of, in coal gasification with regenerable sorbents)

L52 ANSWER 17 OF 24 HCA COPYRIGHT 2005 ACS on STN
117:257286 Treatment of gas. Rathbone, Thomas (BOC Group PLC, UK).
Brit. UK Pat. Appl. GB 2250217 A1 19920603, 20 pp.
(English). CODEN: BAXXDU. APPLICATION: GB 1991-25057 19911126.
PRIORITY: GB 1990-25846 19901128.
AB Gases contg. H₂S are partially combusted in a furnace with O₂ from
an air sepn. process to form SO₂ and H₂O; a portion of the SO₂
reacts with the H₂S to form elemental S which is condensed out and
recovered. The N₂ recovered from the air sepn. is recompressed to
.gtoreq.2 atm., heat exchanged with the hot gas stream, and expanded
in a gas turbine to recover useful energy. The method is
cost-effective and suitable for both waste gases and petroleum
processing gases.
IT 7704-34-9P, Sulfur, preparation
(recovery of, from waste gases, by Claus process, heat recovery
in)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

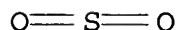
S

IT 7446-09-5, Sulfur dioxide, miscellaneous

(removal of, from waste gases, by Claus process, in)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IC ICM B01D053-34

ICS C01B017-04

CC 59-4 (Air Pollution and Industrial Hygiene)

Section cross-reference(s): 49, 51

IT Air **purification**

(sepn., **oxygen** and nitrogen from, in heat and sulfur recovery from waste gases by Claus process)

IT 7704-34-9P, Sulfur, preparation

(recovery of, from waste gases, by Claus process, heat recovery in)

IT 7446-09-5, Sulfur dioxide, miscellaneous

(removal of, from waste gases, by Claus process, in)

L52 ANSWER 18 OF 24 HCA COPYRIGHT 2005 ACS on STN

117:218984 Heat exchanger and pollutant removal system for flue gas treatment.. Johnson, Arthur F. (USA). U.S. US 5122352 A

19920616, 8 pp. Cont.-in-part of U.S. Ser. No. 372,492, abandoned. (English). CODEN: USXXAM. APPLICATION: US 1990-567492 19900814. PRIORITY: US 1988-165312 19880308; US 1989-372492 19890628.

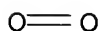
AB SO₂ and SO₃ are removed from flue gases by 2-step cooling in the heat exchanger furnished with 2 condensing sections. In the 1st step SO₃ is condensed to H₂SO₄ and removed from the heat exchanger; alternatively, a (NH₄)₂SO₄ soln. is removed from the heat exchanger when a small amt. of base, e.g., NH₄OH, is added to the flue gases. In the 2nd step the flue gas is cooled in a much longer length of closely spaced layers of boiler feedwater tubes to dissolve the S which has oxidized to SO₂ (sol. in cold water); the resulting SO₂ soln. can then be subjected to vacuum to **recover** SO₂, which in turn can be absorbed by a (NH₄)₂SO₃ soln. to give (NH₄)₂SO₄. The heat-exchange efficiency is substantially improved.

IT 7782-44-7, Oxygen, uses

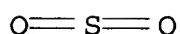
(in removal of sulfur compds. from flue gases by two-step cooling)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IT 7446-09-5, Sulfur dioxide, miscellaneous 7704-34-9
, Sulfur, miscellaneous
(removal of, from flue gases, two-step cooling in)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IC ICM C01B017-00
ICS C01B017-69; C01C001-24; F28B003-00
INCL 423242000
CC 59-4 (Air Pollution and Industrial Hygiene)
IT 7664-41-7, Ammonia, uses 7664-93-9, Sulfuric acid, uses
7782-44-7, Oxygen, uses 7783-20-2, Ammonium sulfate, uses
10028-15-6, Ozone, uses 10102-44-0, Nitrogen dioxide, uses
10196-04-0, Ammonium sulfite 14798-03-9, Ammonium, uses
(in removal of sulfur compds. from flue gases by two-step
cooling)
IT 7446-09-5, Sulfur dioxide, miscellaneous 7446-11-9, Sulfur
trioxide, miscellaneous 7704-34-9, Sulfur, miscellaneous
11104-93-1, Nitrogen oxide, miscellaneous
(removal of, from flue gases, two-step cooling in)

L52 ANSWER 19 OF 24 HCA COPYRIGHT 2005 ACS on STN

116:158053 Cyclic process for the removal of **sulfur**
dioxide and the **recovery** of sulfur from gases.

Lo, Ching Lung (USA). U.S. US 5066470 A 19911119, 5 pp.

(English). CODEN: USXXAM. APPLICATION: US 1990-550319 19900709.

AB Gases contg. SO₂ are scrubbed with an aq. Fe³⁺ soln. contg. BaCl₂ or
CaCl₂ to form SO₃ which forms H₂SO₄ in water. The H₂SO₄ reacts with
the Ba or Ca to form the sulfate which is pptd. and sepd. by
filtration. The BaSO₄ or CaSO₄ is reduced to BaS or CaS, using a
carbonaceous material or reducing gas. The BaS or CaS is reacted
with another portion of the Fe³⁺-contg. soln. to form elemental S
and regenerate BaCl₂ or CaCl₂. After sulfur removal, this soln. is
rich in Fe²⁺ and is combined with the soln. from which BaSO₄ was
removed and oxidized. The soln. can then be recycled. The method
removes almost all the SO₂ as S in a closed system.

IT 7782-44-7, Oxygen, uses
(in sulfur dioxide removal from waste gases by cyclic process for
sulfur recovery)

RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7704-34-9P, Sulfur, preparation
(recovery of, in sulfur dioxide
removal from waste gases by cyclic process)

RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5, Sulfur dioxide, miscellaneous
(removal of, from waste gases, cyclic process for sulfur recovery
in)

RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IC ICM C01G001-00
ICS C01B017-00; C01F007-74

INCL 423242000

CC 59-4 (Air Pollution and Industrial Hygiene)

IT 7440-44-0, Carbon, uses 7647-01-0, Hydrochloric acid, uses
7705-08-0, Ferric chloride, uses 7782-44-7, Oxygen, uses
10043-52-4, Calcium chloride, uses 10361-37-2, Barium chloride,
uses
(in sulfur dioxide removal from waste gases by cyclic process for
sulfur recovery)

IT 7704-34-9P, Sulfur, preparation
(recovery of, in sulfur dioxide
removal from waste gases by cyclic process)

IT 7446-09-5, Sulfur dioxide, miscellaneous
(removal of, from waste gases, cyclic process for sulfur recovery
in)

L52 ANSWER 20 OF 24 HCA COPYRIGHT 2005 ACS on STN

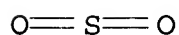
109:195327 Equilibrium gas compositions for the sulfur dioxide-oxygen
system and their application to the sulfidation of copper. Gawel,
J.; Wyczasany, A. (Tech. Univ. Cracow, Krakow, 31-155, Pol.).
Corrosion Science, 28(9), 867-72 (English) 1988. CODEN:
CRRSAA. ISSN: 0010-938X.

AB Equil. compns. for theor. gas mixts. formed during heating of

pure and O contaminated SO₂ at 1073 K were calcd.

The partial pressure of S in these gas mixts. is sufficiently high for formation of some metal sulfides even if the O contamination of initial gases is relatively high. On this basis, the formation of Cu₂S at high temps. is explained.

IT 7446-09-5, Sulfur dioxide, uses and miscellaneous
(partial pressure of, in contaminated oxygen atm., with respect to metal sulfidation)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IT 7704-34-9
(sulfurization and Sulfidization, of metals, in sulfur dioxide-contaminated oxygen)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

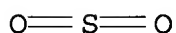
CC 56-10 (Nonferrous Metals and Alloys)
IT 7446-09-5, Sulfur dioxide, uses and miscellaneous
(partial pressure of, in contaminated oxygen atm., with respect to metal sulfidation)
IT 7704-34-9
(sulfurization and Sulfidization, of metals, in sulfur dioxide-contaminated oxygen)

L52 ANSWER 21 OF 24 HCA COPYRIGHT 2005 ACS on STN
75:91643 Equilibriums in the systems carbon-oxygen-sulfur and carbon-oxygen-sulfur-hydrogen as related to sulfur **recovery** from **sulfur dioxide**. Kellogg, H. H. (Henry Krumb Sch. Mines, Columbia Univ., New York, NY, USA). Metallurgical Transactions, 2(8), 2161-9 (English) 1971. CODEN: MTGTBF. ISSN: 0026-086X.

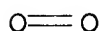
AB Equil. phase diagrams for the systems, showing gas compn. as a function of temp. for the C- and S-satn. surfaces, were calcd. from thermochem. data on the numerous gas species present. Recent exptl. work of J. Drowart, et al. (1967) was used to obtain consistent thermodynamic behavior for the 7 polymers of S (S_n, n = 2 to 8). For the system C-O-S-H, only the pseudoternary at the const. atom ratio H/C = 4.0 is presented. An iterative procedure, adapted for the digital computer, was used to solve the complex equil. involved. The influence of the equil. chemistry on the design of processes to reduce SO₂ with C, CO, and CH₄ is discussed. In all cases,

production of S vapor reaches a sharp max. at the gas compn. having the atom ratio $(H + C)/O = (1 + X)/(2 + X/2)$, where X is the atom ratio H/C in the reducing agent. Reducing agents with lower values of X yield better S recovery because of the smaller residual amt. of H₂S and SO₂ in the reacted gas.

IT 7446-09-5, reactions
(redn. of, by carbon compds.)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)



IT 7782-44-7, properties
(systems: carbon--hydrogen--sulfur--)
RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IT 7704-34-9, properties
(systems: carbon--hydrogen--oxygen--)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

CC 68 (Phase Equilibriums, Chemical Equilibriums, and Solutions)
IT 7446-09-5, reactions
(redn. of, by carbon compds.)
IT 7782-44-7, properties
(systems: carbon--hydrogen--sulfur--)
IT 7704-34-9, properties
(systems: carbon--hydrogen--oxygen--)

L52 ANSWER 22 OF 24 HCA COPYRIGHT 2005 ACS on STN

51:14597 Original Reference No. 51:3100a-b Recovery of sulfur from hydrogen sulfide. Conroy, Edward H., Jr.; Eads, David K.; West, James R. (Texas Gulf Sulphur Co.). US 2765217 19561002 (Unavailable). APPLICATION: US .

AB Substantially quant. conversion of H₂S and recovery of S are accomplished in a cyclic process in which H₂S is converted to S by means of O and SO₂ which are added in stoichiometric amts. The gases, after cooling to condense S which is then removed, are passed into a secondary combustion chamber where sufficient O is used to oxidize unreacted H₂S and uncondensed S to SO₂. The latter is then

recovered, e.g. by liquid absorption.

IT 7782-44-7, Oxygen
(in sulfur recovery from H₂S)
RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7704-34-9, Sulfur
(recovery of, from H₂S)
RN 7704-34-9 HCA
CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7446-09-5, Sulfur dioxide
(sulfur **recovery** from H₂S and)
RN 7446-09-5 HCA
CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

CC 18 (Acids, Alkalies, Salts, and Other Heavy Chemicals)
IT 7782-44-7, Oxygen
(in sulfur recovery from H₂S)
IT 7704-34-9, Sulfur
(recovery of, from H₂S)
IT 7446-09-5, Sulfur dioxide
(sulfur **recovery** from H₂S and)

L52 ANSWER 23 OF 24 HCA COPYRIGHT 2005 ACS on STN
47:52693 Original Reference No. 47:8935g-i,8936a-i,8937a-e American
Society for Testing Materials, Standards, 1952. V. Fuels, petroleum,
aromatic hydrocarbons, engine antifreezes. 1253 pp. (Unavailable)
1952.
AB Standards or tentative standards, adopted or revised in 1952 are
given for: distn. of crude petroleum; gravity of petroleum and its
products; ASTM-IP petroleum measurement tables; reduced pressure
distn. of petroleum products; test for S in petroleum products and
lubricants; test for water in petroleum products and other
bituminous materials; test for water and sediment; definitions of
terms relating to petroleum; test for C₂H₂ in polymerization-grade
butadiene; tests for b.p. range and butadiene content of
polymerization-grade butadiene; carbonyl content of butadiene; test
for 1,3-butadiene in C₄ hydrocarbon mixts.; measurement of f.ps. for

evaluation of **purity**; tests for **O** in butadiene vapors and for peroxides in butadiene; detn. of purity from f.p.s.; sampling petroleum and petroleum products; tests for sepn. of residue from butadiene and for butadiene dimer and nonvolatile residue of polymerization-grade butadiene; test for total inhibitor content (p-tert-butylcatechol) of butadiene; distn. test of gasoline, naphtha, kerosine, and similar petroleum products; test for viscosity and for flash and fire points; tests for flash point by Pensky-Martens closed tester and by Tag closed tester; method of calcg. viscosity index; conversion of kinematic viscosity to Saybolt Furol viscosity; vacuum distn. of liquid and semi-solid asphaltic materials to obtain a residue of specified penetration; test for softening point; asphalt-base emulsions for use as protective coatings for built-up roofs; gasoline and aviation gasoline; acidity of residue from distn. of gasoline and of petroleum solvents; analysis of 60 octane no. isooctane-normal heptane ASTM knock test reference fuel blends; test for aromatic hydrocarbons in olefin-free gasolines; test for autogenous ignition temps. of petroleum products; tests for C₆H₆ and toluene, Br no. of petroleum distillates, color of refined petroleum oil, and color of U.S. Army motor fuel; measurement of d. and sp. gr. of liquids; distn. of natural gasoline; gaging petroleum and petroleum products; test for existent gum in fuels and in gasoline; test for H in petroleum fractions; test for knock characteristics of aviation and motor fuels; test for mercaptan S in jet fuels; test for olefins and aromatics in petroleum distillates; test for oxidation stability of gasoline and aviation gasoline; measurement of refractive index and refractive dispersion of hydrocarbon liquids; test for free and corrosive S in petroleum products; test for S in petroleum products; test for tetraethyllead in gasoline; tests for heat of combustion of liquids, and of vapor pressure of petroleum products; vol. calcns. and corrections in measurement of petroleum and petroleum products; test for water tolerance of aviation fuels; petroleum spirits; Stoddard solvent; reagent water; test for d. of hydrocarbon liquids; test for distn. range of lacquer solvents and diluents; tests for heptane no.; kauri-butanol value and nitrocellulose dilg. power of hydrocarbon solvents; test for olefinic plus aromatic hydrocarbons in petroleum distillates; classification of Diesel fuel oils; farm tractor fuels and fuel oils; test for aniline point and mixed aniline point of petroleum products and hydrocarbon solvents; test for ash content of petroleum oils; test for burning qualities of kerosine, mineral seal oil, and of long-time burning oil for railway use; test for C residue of petroleum products; test for cloud and pour points; distn. test of gas oil and similar distillate fuel oils; test for ignition value of Diesel fuels; test for neutralization value (acid and base nos.); test for sediment in fuel oil; conversion of kinematic viscosity to Saybolt universal viscosity; test for kinematic viscosity; test for Cl in lubricating

oils and greases; test for color of lubricating oil and petrolatum; test for diln. of crankcase oils; tests for steam emulsion of lubricating oils and evapn. loss of lubricating greases and oils; test for foaming characteristics of crankcase oils; chem. analysis for metals in lubricating oils; test for normal pentane and C₆H₆ insolubles in used lubricating oils; test for P in lubricating oils, lubricating-oil additives, and their concentrates; sampling coals classed according to ash content; lab. sampling and analysis of coal and coke; sampling and fineness test of powd. coal; sampling and analysis of coal for volatile-matter detn.; test for grindability and screen analysis of coal; drop shatter and tumbler tests for coal; designating the size of coal from screen analysis; test for size of anthracite; tests for sieve analysis and cu. ft. wt. of crushed bituminous coal; index of dustiness of coal and coke; test for free-swelling index of coal; classification of coals by rank and grade; gas and coking coals; sieves for testing purposes; definitions of terms relating to coal and coke; gross and net calorific values of solid and liquid fuels, and of com. varieties of bituminous and sub-bituminous coals; sampling coke for analysis; test for vol. of cell space of lump coke; drop shatter and tumbler tests of coke; tests for sieve analysis and cu. ft. wt. of coke; test for sp. gr. and calorific value of gaseous fuels; analysis of natural gases and related types of gaseous mixts.; test for water-vapor content of gaseous fuels; sampling manufd. gas; industrial 90, nitration and industrial-grades C₆H₆; refined, crude light, and crude heavy solvent naphthas; nitration and industrial-grades toluene; 5.degree., 10.degree., nitration, and industrial-grades xylene; test for acidity and acid wash color of C₆H₆, toluene, xylenes, solvent naphthas, and similar industrial aromatic hydrocarbons; test for Cu corrosion, distn., and paraffins of industrial aromatic hydrocarbons; test for solidifying point of benzenes; tests for sp. gr., color, H₂S, and SO₂ content of industrial hydrocarbons; test for thiophene in C₆H₆; hydrometer-thermometer field test and b.p. of engine antifreezes; tests for ash content, reserve alky., sp. gr., and water of concd. antifreezes; test for pptn. no. of lubricating oils; test for sapon. no. of petroleum products; test for Na in lubricating oil and lubricating-oil additives; test for sulfated residue from new lubricating oils; test for sulfated residue, Pb, Fe, and Cu in new and used lubricating oils; viscosity-temp. charts for liquid petroleum products; test for interfacial tension of oil against water; test for oxidation characteristics of inhibited steam-turbine oils; test for rust-preventing characteristics of steam-turbine oil in the presence of water; tests for elec. insulating oils, askarels, inorg. chlorides and sulfates in insulating oils, dielec. strength of insulating oils of petroleum origin, and gas content of insulating oils; test for power factor and dielec. const. of elec. insulating oils of petroleum origin; sampling elec. insulating oils;

test for sludge formation in mineral transformer oil; detection of free S in elec. insulating oils; purchase of uninhibited mineral oil for use in transformers and oil circuit breakers; analysis of Ca, Ba, and oil-sol. Na petroleum sulfonates; distn. test of plant spray oils; test for unsulfonated residue of petroleum plant spray oils; analysis of grease; apparent viscosity, cone penetration, and dropping point of lubricating grease; test for oxidation stability of lubricating greases; test for carbonizable substances in paraffin wax and white mineral oil; test for congealing point of pharmaceutical petrolatums; testing hydrocarbon waxes used for elec. insulation; m.ps. of paraffin wax, petrolatum, and microcryst. wax; test for oil content of paraffin wax; test for penetration of petrolatum; measurement of gaseous fuel samples; measuring temp. of petroleum and petroleum products; sampling natural gas; sampling and prepg. aq. solns. of engine antifreeze for testing purposes; f.p. of aq. engine antifreeze solns.; detn. of pH of aq. solns. with glass electrode; designating significant places in specified limiting values; definitions of terms relating to sp. gr., screen, rheological properties of matter, and of conditioning and weathering; ASTM thermometers; and method of testing and standardization of etched-stem liquid-in-glass thermometers. Tentative revisions submitted in 1952 are given for: test for existent gum in gasoline.

IT 7704-34-9, Sulfur
 (analysis, detn. in elec. insulating oils)
 RN 7704-34-9 HCA
 CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

 (analysis, detn. in lubricants and petroleum products
 (analysis, detn. in petroleum products
 IT 7446-09-5, Sulfur dioxide
 (detn. of, in industrial hydrocarbons)
 RN 7446-09-5 HCA
 CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

CC 13 (Chemical Industry and Miscellaneous Industrial Products)
 IT 7704-34-9, Sulfur
 (analysis, detn. in elec. insulating oils)
 IT 7704-34-9, Sulfur
 (analysis, detn. in lubricants and petroleum products)
 IT 7704-34-9, Sulfur
 (analysis, detn. in petroleum products)

IT 7446-09-5, Sulfur dioxide 7783-06-4, Hydrogen sulfide
(detn. of, in industrial hydrocarbons)

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46:12854 Original Reference No. 46:2267d-g Recovery of sulfur from flue gas by the use of ammonia. Craxford, S. R.; Poll, A.; Walker, W. J. S. Journal of the Institute of Fuel, 25, 13-14 (Unavailable) 1952. CODEN: JIFUA4. ISSN: 0020-2886.

AB Before World War II, Simon-Carves and the Metropolitan Borough of Fulham proposed the use of NH₃ for scrubbing the gases emitted from elec. power plants, to reduce the pollution of the atm. by S oxides, and to recover the S in a useful form. They found it difficult to control the compn. of the scrubber liquid so that neither NH₃ nor SO₂ was lost with the scrubbed gas, but they invented an elec.-cond. vapor-pressure recorder to overcome this difficulty. A small plant is described for treating 1000 cu. ft. of flue gas per hr. from a Lancashire boiler, by using the vapor pressure recorder. As a scrubber this plant was entirely satisfactory, and when the compn. of the liquor was right, the concn. of SO₂ in the exit gas was found regularly to be as low as 0.0005%, corresponding to the removal of some 99% of the SO₂ in the flue gas. The control of the compn. of the liquor was difficult at first, owing to the building up of excessive concns. of sulfites and bisulfites, but the addn. of a little oxidation catalyst (MnSO₄) overcame this difficulty. Later, it was found that Fe oxide in the system served the same purpose. The liquor is converted into S and a soln. of (NH₄)₂SO₄ by heating in an autoclave at 190.degree. with the requisite amt. of H₂SO₄. The results were so successful that a plant for treating 25,000 cu. ft. per hr. of flue gas has been built and is now in operation at the Fuel Research Station.

IT 7446-09-5, Sulfur dioxide
(recovery of, from flue gas)

RN 7446-09-5 HCA

CN Sulfur dioxide (8CI, 9CI) (CA INDEX NAME)

O=S=O

IT 7704-34-9, Sulfur
(recovery of, from flue gases)

RN 7704-34-9 HCA

CN Sulfur (8CI, 9CI) (CA INDEX NAME)

S

IT 7782-44-7, Oxygen
(removal of, from gases)

RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

CC 21 (Fuels and Carbonization Products)
IT Catalysts
 (in oxidation, of sulfites in **SO2 recovery**,
 MnSO4 as)
IT Oxidation
 (of sulfite, in **SO2 recovery**)
IT 7785-87-7, Manganese sulfate, MnSO4
 (as catalyst in oxidation of sulfites in **SO2**
 recovery)
IT 7446-09-5, **Sulfur dioxide**
 (**recovery** of, from flue gas)
IT 7704-34-9, Sulfur
 (recovery of, from flue gases)
IT 7782-44-7, Oxygen 7783-06-4, Hydrogen sulfide
11104-93-1, Nitrogen oxides
 (removal of, from gases)